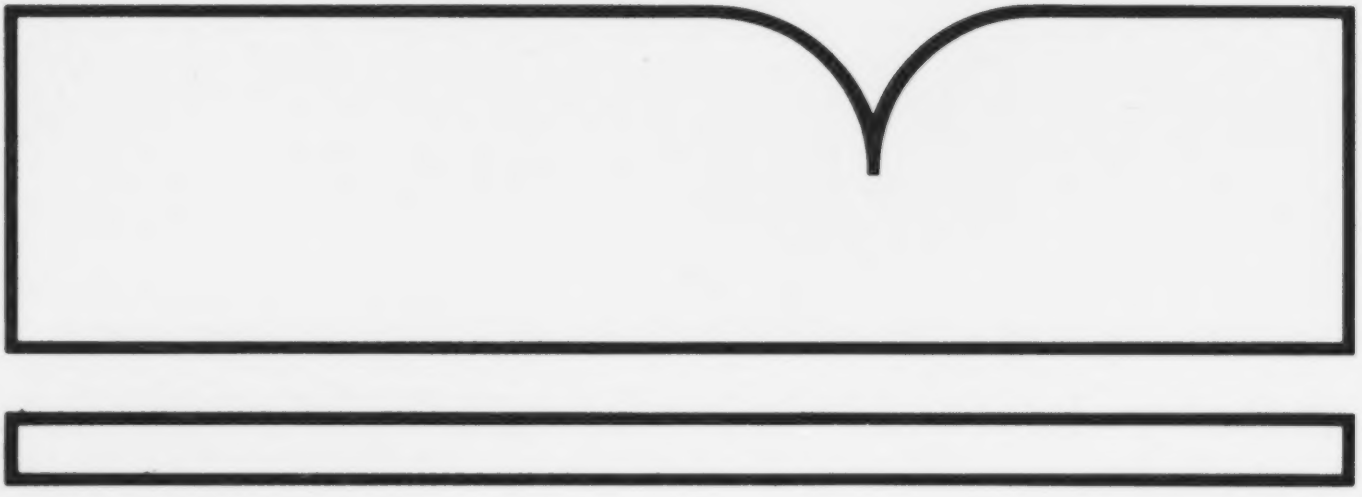
PB86-224896

Superfund Record of Decision (EPA Region 8) Denver Radium Site Streets, Colorado, March 1986

(U.S.) Environmental Protection Agency
Washington, DC

24 Mar 86



U.S. Department of Commerce
National Technical Information Service
NTIS

United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R08-86/004
March 1986

PB86-224896

EPA

Superfund Record of Decision:

Denver Radium Site Streets, CO

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

TECHNICAL REPORT DATA *(Please read Instructions on the reverse before completing)*		
1. REPORT NO. EPA/ROD/R08-86/004	2.	3. RECIPIENT'S ACCESSION NO. PB86 224896/AS
4. TITLE AND SUBTITLE SUPERFUND RECORD OF DECISION Denver Radium Site Streets, CO		5. REPORT DATE March 24, 1986 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Same as box 12.		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS U.S. Environmental Protection Agency 401 M Street, S.W. Washington, D.C. 20460		13. TYPE OF REPORT AND PERIOD COVERED Final ROD Report 14. SPONSORING AGENCY CODE 800/00
15. SUPPLEMENTARY NOTES		

16. ABSTRACT

Denver Radium Site Streets is located in Denver, Colorado. This operable unit is comprised of eight street segments in the Cheesman Park area and one segment in the upper downtown area. The nine contaminated street segments are owned by the City and County of Denver and extend approximately 4.5 miles through largely residential areas. The Denver Radium Site Streets contain a 4- to 6-inch layer of radium contaminated asphalt. The contaminated layer is underlain by compacted gravel road base and is usually overlain by 4 to 12 inches of uncontaminated asphalt pavement. There is an estimated 38,500 cubic yards of contaminated material covering approximately 832,000 square feet. Radioactive contamination does not extend beyond the paved right-of-way of the streets and generally does not appear to have migrated into the soils below the contaminated asphalt. Radium concentrations at representative locations on the streets range from 4 to 79 picocuries per gram. Surface gamma radiation readings generally fall below 20 microroentgens per hour above background.

The selected remedial action for this site includes: leaving the contaminated material in place; improving institutional controls; and removing any contaminated material excavated during routine maintenance, repair, or construction activities in the affected streets to a facility approved for storage or disposal of contaminated material. The estimated initial cost of the remedy is $30,000. This includes the cost of studying and (See Attached Sheet)

17. KEY WORDS AND DOCUMENT ANALYSIS		
a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Record of Decision Denver Radium Site Streets, CO Contaminated Media: asphalt Key contaminants: radium		
18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)* None	21. NO. OF PAGES 72
	20. SECURITY CLASS *(This page)* None	22. PRICE

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE

16. ABSTRACT (continued)

then establishing the institutional controls which would monitor all construction and utility work for the affected streets. The annual operation and maintenance cost will vary depending upon the amount of material excavated during any particular year.

ATTENTION

AS NOTED IN THE NTIS ANNOUNCEMENT,

PORTIONS OF THIS REPORT ARE NOT LEGIBLE.

HOWEVER, IT IS THE BEST REPRODUCTION

AVAILABLE FROM THE COPY SENT TO NTIS.

DIRECT QUESTIONS RESULTING FROM ILLEGIBILITY

TO: MS. B. SHAW
U. S. EPA SUPERFUND
OSWER-HSCD
401 M STREET, S. W.
WASHINGTON, D. C. 20460
202-382-3304

Record of Decision

Remedial Alternative Selection

Site Name: Denver Radium Site Streets
Operable Unit 7

Site Location: Denver, Colorado

Documents Reviewed

I have reviewed the following documents describing the analysis of the remedial alternatives for the Denver Radium Site Streets Operable Unit:

- Denver Radium Streets Feasibility Study, prepared for the EPA Region VIII by CH2M Hill, July 26, 1985.
  - City and County of Denver recommendations/comments on FS.
  - Colorado Department of Health recommendations/comments on FS.
  - DOE recommendations/comments on FS prepared by Bendix Field Engineering Corp, August 29, 1985.
  - Endangerment Assessment (Appendix A of FS).
  - EPA Region VIII Staff recommendations/comments on FS.
  - General public recommendations/comments on FS.
- Denver Radium Sites Disposal Method Study, prepared for the Colorado Department of Health by Dames & Moore, March, 1983.
- Engineering Assessment and Remedial Action Plan for Radium Processing Residues at Nine Streets and One Alley in the City and County of Denver, Colorado, unpublished Report prepared for the Colorado Department of Health by Arix, Inc., 1982.
- Letter from Colorado Department of Health dated February 18, 1986 containing comments on the draft Streets ROD.
- Memorandum dated March 3, 1986 from Philip Nyberg to John Brink pertaining to Radiation Protection Standards.
- National Oil and Hazardous Waste Pollution Contingency Plan, 40 CFR Part 300.
- Responsiveness Summary, prepared for EPA Region VIII by CH2M Hill, January 13, 1986, (attached).
- Standards for Remedial Actions at Inactive Uranium Processing Sites, 40 CFR Part 192.
- Summary of Remedial Alternative Selection, EPA Region VIII, January 9, 1986, (attached).

Description of Selected Remedy

The EPA selected remedy combines features of excavation and disposal with the Modified No Action Alternative. This remedy entails:

- leaving the contaminated material in place,
- improving institutional controls so that all routine maintenance, repair, or construction activities in the affected streets by government agencies, utility companies, contracting companies, and private individuals will be monitored, and
- removing any contaminated material excavated during routine maintenance, repair, or construction activities in the affected streets to a facility approved for storage or disposal of contaminated material.

The EPA may share in the capital costs of designing improved institutional controls to be implemented by the City and County of Denver. Consistent with CERCLA Section 104(c)(3), the State of Colorado or the City and County of Denver will be responsible for assuring the payment of all future costs of maintaining and operating the institutional controls, including proper disposal of any contaminated material excavated during routine maintenance, repair, or construction activities in the affected streets.

Declarations

Consistent with the Comprehensive Environmental Response, Compensation tion, and Liability Act of 1980 (CERCLA), and the National Contingency Plan (40 CFR Part 300), I have determined that the selected remedy described in the preceding section at the Denver Radium Site Streets Operable Unit is a cost-effective remedy that effectively mitigates and minimizes threats to and provides adequate protection of public health, welfare, and the environment. The action will require future operation and maintenance activities by the State of Colorado or the City and County of Denver to ensure the continued effectiveness of the remedy. These activities will be considered part of the approved action and will be funded by the State of Colorado or subdivision thereof. The selected remedy is the alternative which the State of Colorado recommended in its August 12, 1985 comments on the Feasibility Study. The State has reviewed and commented on the Record of Decision.

I have also determined that the action being taken is appropriate when balanced against the availability of Trust Fund monies for use at other sites. In addition, the limited off-site transport and secure disposition of the contaminated material recommended in the institutional controls is more cost-effective than any other remedial action and is necessary to protect public health, welfare, or the environment from the misuse of contaminated material excavated from the Denver Radium Site Streets Operable Unit in the course of any routine maintenance, repair, or construction activities in the affected streets.

3/24/86

John G. Welles
Regional Administrator
Region VIII
U.S. Environmental Protection Agency

Date

Summary of Remedial Alternative Selection

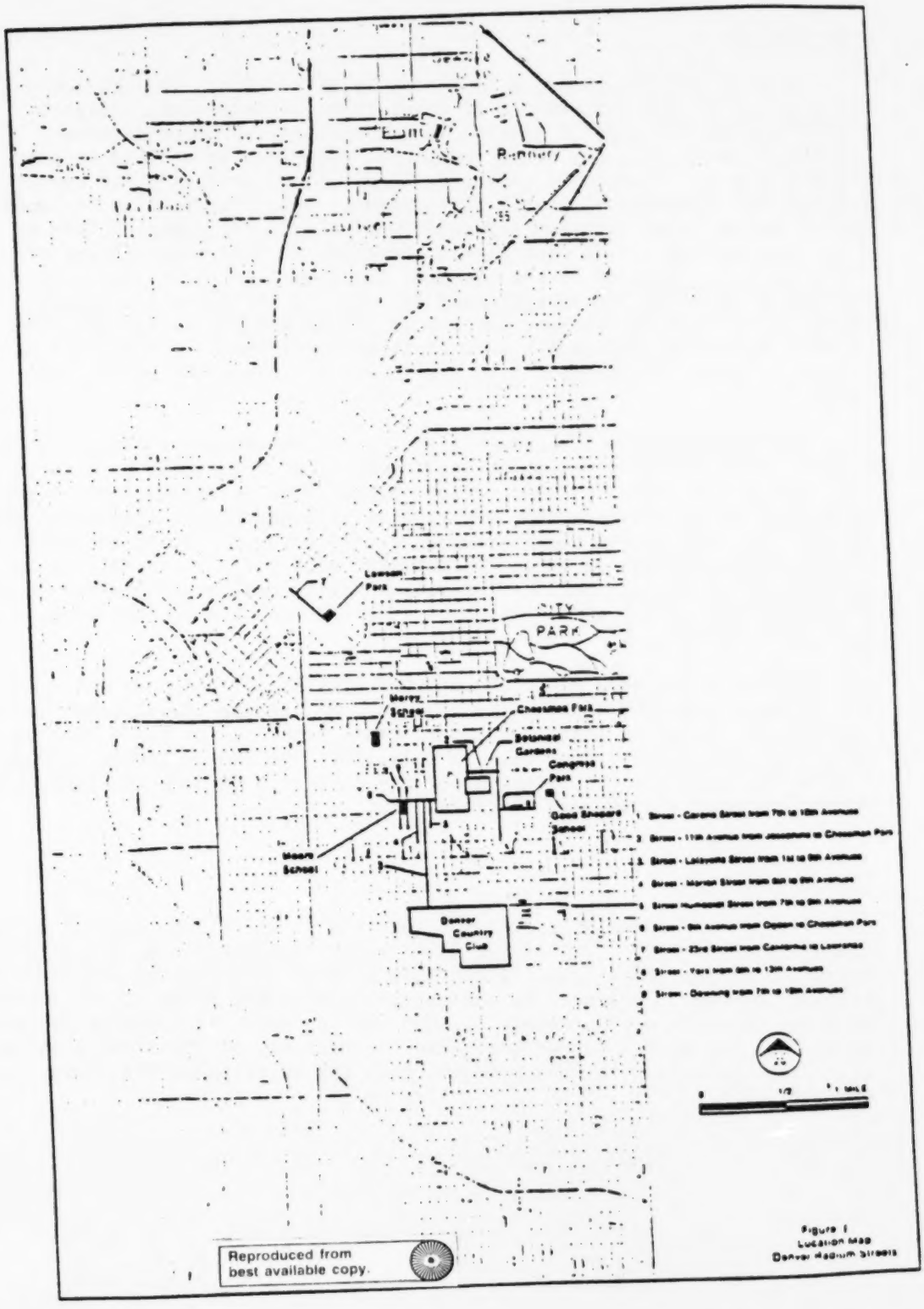
Site Name: Denver Radium Site Streets
Operable Unit 7

Site Location

Denver Radium Site Streets Operable Unit is located in Denver, Colorado. The Operable Unit is comprised of eight street segments in the Cheesman Park area and one segment in the upper downtown area (See Figure 1):

- 9th Avenue from Ogden Street to Cheesman Park
- 11th Avenue from Josephine Street to Cheesman Park
- 23rd Street from California Street to Lawrence Street
- Corona Street from 7th Avenue to 10th Avenue
- Downing Street from 7th Avenue to 10th Avenue
- Humboldt Street from 7th Avenue to 9th Avenue
- Lafayette Street from 1st Avenue to 9th Avenue
- Marion Street from 6th Avenue to 9th Avenue
- York Street from 6th Avenue to 13th Avenue.

The nine contaminated street segments are owned by the City and County of Denver and extend approximately 4.5 miles tnrough largely residential areas. An estimated 800 households border the contaminated streets. The streets are adjacent to various parks and public-use areas and properties. Except for minimal controls on excavation imposed by the Denver Public Health Engineering and the Denver Public Works Departments, use of the streets has not been restricted.



Reproduced from best available copy.

Figure 1
Location Map
Denver Medium Streets

Site History

In 1979, EPA discovered a reference to Denver's National Radium Institute in a 1916 U.S. Bureau of Mines report. Subsequent research identified the presence of several long-forgotten radium processing operations which were active in the Denver area from about 1914 through the mid-1920's. Production of the refined radium, primarily for cancer therapy and research, generated large quantities of radioactive residues. Radium contaminated tailings and other wastes were discarded or left on site when the facilities were closed. Changes in ownership and use of the properties resulted in the residues being used as cover, fill, and foundation material and as aggregate in concrete and asphalt mixtures. Contaminated asphalt pavement was placed in the streets either when the streets were originally built or when streetcar lines were removed. No conclusive proof which identifies the source of this material has been found.

The Denver Radium Site was placed on the Interim Priorities List in October 1981. Final promulgation to the National Priorities List (NPL) occurred on September 8, 1983. After initial site discovery, the Colorado Department of Health undertook engineering assessment work using RCRA grant funds. The nine street segments were identified by the State contractor, the Arix Corporation, as being contaminated with radioactive materials. As a result of the Arix study, the Denver Public Health Engineering Department began monitoring gamma radiation levels during any excavation carried out in the streets.

State studies were discontinued when RCRA grant funds ran out. The EPA resumed fund-lead RI/FS activities in 1983 because the Colorado State Legislature failed to approve the cost share required for RI/FS funding under EPA's policy at the time. In July 1985, the EPA completed a study further defining the contamination of the streets. On July 26, 1985, the Draft Feasibility Study was released.

Site Description

The Denver Radium Site Streets contain a 4- to 6-inch layer of radium-contaminated asphalt. The contaminated layer is underlain by compacted gravel road base and is usually overlain by 4 to 12 inches of uncontaminated asphalt pavement. There is an estimated 38,500 cubic yards of contaminated material covering approximately 832,000 square feet. Radioactive contamination does not extend beyond the paved right-of-way of the streets and generally does not appear to have migrated into the soils below the contaminated asphalt.

Radium concentrations at representative locations on the streets range from 4 to 79 picocuries per gram (Table 1). (Units of measurement are described in Section 1.4 of the Feasibility Study and in the Endangerment Assessment.) These levels exceed the standards for "Remedial Actions at Inactive Uranium Processing Sites," 40 CFR Part 192, which serve both as the initiator and the goal of the remedial actions at the Denver Radium Site. Surface gamma radiation readings generally fall below 20 microroentgens per hour above background (Table 2 and Figure 2). The peak gamma level reported to date is 57 microroentgens per hour. Gamma exposure rates in outdoor contaminated areas are not directly addressed in 40 CFR Part 192. However, the gamma exposure levels found in the streets are well below the guidelines set by Federal agencies such as the Nuclear Regulatory Commission (NRC) and by national and international advisory groups such as the National Committee on Radiation Protection and Measurements (NCRP) and the International Commission on Radiological Protection (ICRP).

Current Site Status

The Denver Radium Site Streets Operable Unit poses a minimal threat to public health. There is every indication that the material is bound in the asphalt and is not free to move in any direction. As long as the material remains in its present location, the potential routes of human exposure to the radioactivity are limited because the contaminated material is well contained. None of the streets are near surface water or groundwater resources and the material has little potential for erosion or leaching due to the pavement capping. For these reasons, contamination of the surface water or groundwater is not considered a potential exposure pathway.

The most significant routes of exposure to the radiation associated with the Denver Radium Site Streets material are, in order of decreasing significance: (1) inhalation of radon gas and its decay products, which are the immediate decay products of the radium, (2) direct gamma radiation exposure from the decay of radium and its progeny, and (3) ingestion or inhalation of radium-contaminated material. In general, the greater the exposure rate and the longer the exposure to radiation, the greater the associated health risks. Each of the three exposure routes will be examined briefly in order to describe the potential health risks.

Inhalation of Radon Decay Products:

Radon gas and its decay products, called daughters, present the greatest health hazard of long-term exposure. Radon daughters may attach to airborne particulates and be inhaled. The lungs and internal organs are then exposed to the highly ionizing particles which the radon daughters

Table 1
RADIUM CONCENTRATION
DENVER RADIUM STREETS

Boring No.	Location[2]	Contamination[1] Depth (inches)	Pavement Thickness (inches)	Maximum Radium Concentration (pCi/gm)
1	York St. near 7th Ave.	18	12	54
2	York St. near 11th Ave.	10	10	25
3	11th Ave. near Race St.	16	4	36
4	9th Ave. near Cheesman Park	--	5.5	12
5	Humbolt St. near 7th Ave.	5	5	52
6	Downing St. near 10th Ave.	6	6	79
7	Marion St. near 8th Ave.	6	6	16
8	23rd St. near California St.	6	6	3
9	23rd St. near Lawrence St.	--	10.5	4
10	7th Ave. near Marion St.	--	6	4
11	Lafayette St. near 1st Ave.	6	6	19
12	Lafayette St. near 5th Ave.	12	6	70

[1]Contamination defined as a 6" (15cm) layer of surface material with greater than 5 pCi/gm radium concentration or a 6" (15cm) layer of subsurface material with greater than 15 pCi/gm radium concentration.

[2]Reference: EPA, 1985b.

Reproduced from best available copy.

Table 2
LEVELS OF GAMMA RADIATION
DENVER RADIUM STREETS

Street	Percentage of Contaminated Area[a]			Highest Reading μR/hr
	Less than 20 μR/hr (above background)	20 to 40 μR/hr (above background)	Greater than 40 μR/hr[b] (above background)	
9th Avenue (5-1/2 blocks, 80,000 ft²)	52	46	2	57
11th Avenue (4-1/2 blocks, 60,000 ft²)	57	42	1	50
23rd Street (6 blocks, 120,000 ft²)	93	7	0	23
Corona Street (3 blocks, 30,000 ft²)	73	27	0	29
Downing Street (3 blocks, 30,000 ft²)	84	16	0	34
Humboldt Street (2 blocks, 52,000 ft²)	56	44	0	40
Lafayette Street (9 blocks, 100,000 ft²)	60	40	1	51
Marion Street (4 blocks, 100,000 ft²)	30	67	3	57
York Street (7 blocks, 80,000 ft²)	70	30	1	57

[a]Based on data from Arix, 1982.

[b]The highest gamma radiation level reported is 57 μR/hour above background.

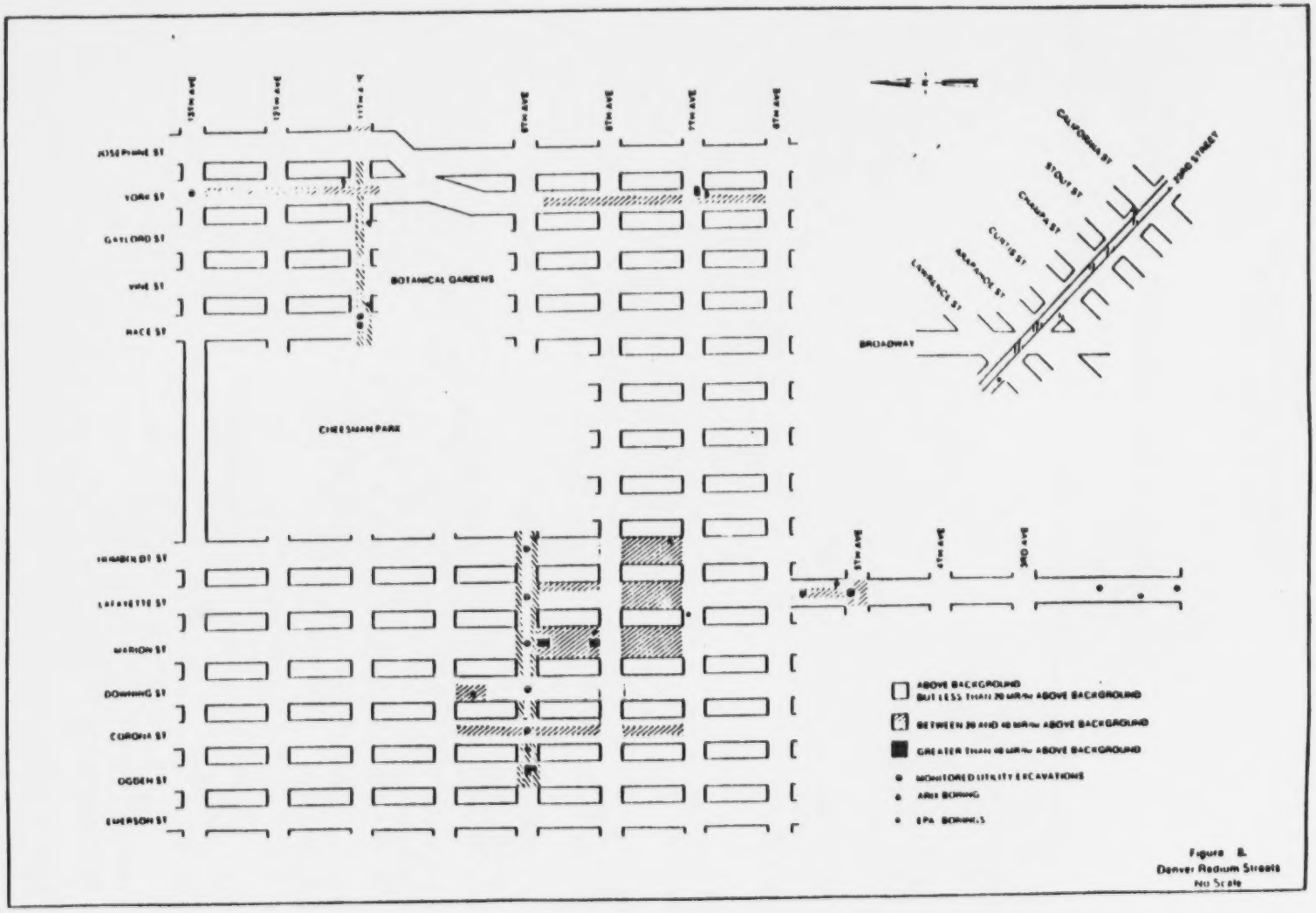


Figure 8.
Denver Radium Streets
No Scale

emit. Prolonged inhalation of radon decay products which are concentrated in the air has been shown conclusively to cause lung cancer in uranium miners. However, no effects have been observed at the lower concentrations to which the general public is exposed.

Radon daughters are not a problem in the out-of-doors where vertical dispersion quickly dilutes the radon emanating from the ground. This mechanism will minimize the concentration of radon in the air above the affected streets. However, radon decay products can concentrate to unacceptable levels in confined spaces such as in buildings built on contaminated ground. This is not a problem in this case because no buildings will be constructed in the streets.

The potential exists for diffusion of radon from the contaminated asphalt into the homes located along the affected streets. However, EPA has calculated that the relatively small amount of contamination in the streets is insufficient to cause elevated levels in any of the homes, given that there is typically 20 to 30 feet of compacted soil between any street and house and possible avenues for gas migration such as loosely filled pipe trenches are isolated from the contaminated asphalt layer. Solid material such as soil will sufficiently retard the diffusion of radon so that the gas will decay into a stable solid product before reaching the homes. This barrier should represent an attenuation factor of over one million times for radon moving from the streets to the homes. The resulting concentration from this source to the houses is negligible.

Gamma Radiation Exposure:

The radioactive decay of radium and its daughter products results in, among other things, the emission of highly penetrating gamma rays. Similar to x-rays, gamma rays are of concern because they can easily penetrate a few centimeters of soil to expose anyone walking above the contaminated area. The gamma ray emission, however, is limited to that area immediately above the contamination and is essentially not measurable beyond the paved rights-of-way of the streets. Furthermore, the gamma radiation exposure rates measured at even the areas of highest contamination in the streets represent a negligible health threat to the casual passerby. For example, if a person were to stand on the location of the highest measured exposure rate (57 microroentgens per hour at York Street) for 16 hours each day, 365 days a year, the resulting dose would be only 330 millirems per year. This may be compared to the guidelines of the Federal Radiation Council (FRC) and others which suggest a maximum annual exposure of no more than 500 millirems per year to any non-occupationally exposed individual member of the general population.

A more realistic case might be the exposure of children playing in the street for two hours each day, five days per week. If the average exposure rate above the contaminated streets is assumed in this case to be 40 microroentgens per hour, the resultant dose would be only about 20 millirems per year - well below the recommended exposure guideline of the National Committee on Radiation Protection and Measurements (NCRP), 100 millirems per year above background, and a small fraction of the approximately 150 millirems that anyone in Denver receives each year from natural natural background radiation (cosmic, terrestrial, and internal).

Inhalation or Ingestion of Radium-Contaminated Material:

While direct ingestion or inhalation of radium-contaminated materials can result in significant doses to various internal organs of the body, the confined location of the material in the streets makes this the least significant of the major exposure routes. For exposure by this route to occur, the material would have to be moved from its current location and made available to the population. Also, it is unlikely that a person will intentionally eat or breathe significant amounts of contaminated material.

From the forgoing discussion it is clear that the radium-contaminated material in the streets represents only a minimal hazard in its present state. This situation will change, however, if the material is disturbed by activities such as utility excavations, trenching, or repaving. Uncontrolled excavation presents the possibility of release and dispersion of the radioactivity, potentially increasing the exposure from all three routes. For this reason, it is important to maintain proper controls over any activities which disturb the status quo so that the risks of population exposure are not unduly increased beyond the presently minimal level. Through proper administrative and technical controls, any disruption of the streets, up to and including complete reconstruction, can be conducted with little additional risk to the workers or the general public.

Enforcement

Responsible party search work presently underway has identified the paving contractors who are thought to have used asphalt containing the contaminated material. Since financially viable, present day successors of the original contractors have not been identified, the Region views the Denver Radium Site Streets as a fund-lead site. There is a potential for cost recovery if a responsible party is identified in the future.

Since the streets were owned by the City and County of Denver at the time of disposal, a minimum of 50% cost-share responsibilities, imposed by CERCLA Section 104(c)(3)(C)(ii), will also apply to the Denver Radium Site Streets. Also, the City and County of Denver could be considered a responsible party under CERCLA Section 107(a)(1) by virtue of its current ownership of the streets.

Alternatives Evaluation

The remedial objectives for the Denver Radium Site Streets Operable Unit are to take actions which protect public health by (1) minimizing the spread of the radium-bearing material to locations where it could pose a hazard and (2) preventing contamination, especially the radium decay progeny, from entering pathways that could result in greater risks of exposure. These objectives are consistent with the National Contingency Plan, 40 CFR Part 300, and the cleanup standards set by the EPA for "Remedial Actions at Inactive Uranium Processing Sites," 40 CFR Part 192. These cleanup standards have been adopted as remedial action objectives for the Denver Radium Site. These standards are relevant and appropriate Federal requirements as defined by the newly revised NCP because it is the radium content of uranium mill tailings which is regulated for the mill tailings cleanup actions. Other Federal criteria, advisories, guidances and State standards which were considered when developing the alternatives are discussed later in this document in the section entitled, "Consistency With Other Environmental Laws."

Initial screening of alternative actions resulted in the elimination of several remedial options because they are technically ill-suited to the site conditions or contrary to the remedial objectives. Among the options rejected are reprocessing/treatment; lead, concrete, or soil shielding for radiation attenuation; area exclusion; and dilution of contaminated material with clean soil.

Complete excavation and disposal of all the contaminated material was also considered. However, the cost of implementing this as a remedy (approximately $8,600,000) far exceeds the cost of the remaining alternatives described below without providing substantially greater public health or environmental protection. Although complete excavation and disposal might be considered the most reliable alternative because all of the contaminated material would be excavated over a short time, other alternatives, including the selected remedy, meet the relevant and appropriate standards at a much lower cost with much less impact on traffic and neighborhoods.

The selected remedy was developed from the remaining alternatives described below:

(1) Limited Excavation and Disposal: Approximately 194 cubic yards of material found within 4,600 square feet of the most contaminated street segments could be excavated and disposed at an EPA-approved facility. This alternative entirely removes the contamination in the areas where there is the greatest public health risk - where gamma radiation levels are greater than 40 microroentgens per hour above background. No action would be taken on the remaining areas.

(2) Asphalt Shielding: Approximately 36% of the total street area could be paved. The areas which show a gamma radiation level over 40 microroentgens per hour above background, approximately 4,600 square feet, would receive 5 inches of asphalt and areas which show a gamma radiation level between 20 and 40 microroentgens per hour above background, approximately 295,000 square feet, would receive 3 inches of asphalt. This alternative would reduce the exposure level by 50% to 70% in the areas of the greatest gamma radiation exposure (more than 20 microroentgens per hour above background).

(3) Limited Asphalt Shielding: Approximately 1% of the most contaminated portion of the streets could be paved. Those areas with gamma level readings greater than 40 microroentgens per hour above background (approximately 4,600 square feet) could be overlain by a 2-inch layer of asphalt. The asphalt "patches" would be tapered on all sides to provide a smooth road surface. This tapering would bring the total area of covered street surface to 8025 square feet. This alternative would reduce the exposure level by approximately 35% in the areas of peak gamma radiation exposure (more than 40 microroentgens per hour above background).

(4) Modified No Action: The contaminated material could be left in place and institutional controls could be established to monitor all routine maintenance, repair, or construction activities in the affected streets. This alternative limits the public health risk by preventing the spread of the contamination to areas where it could potentially enter pathways of exposure that could increase public health risks.

(5) No Action: The contaminated material could be left in place. This alternative does not reduce the public health risk from contamination being spread to areas where it could potentially enter pathways of exposure.

The factors used to evaluate the effectiveness of the remaining alternatives are cost, reliability, feasibility, technology, administraive and other concerns, and their relevant effects on public health, welfare and the environment. Results of the evaluation are summarized below:

(1) Limited Excavation and Disposal: High cost ($148,050); eliminates public health risks of long-term exposure in excavated areas only; high reliability due to the permanent removal and safe disposal of the contaminated material; moderate to high feasibility. Complete excavation and disposal would eliminate public health risks entirely but would cost approximately $8,600,000 - an expense that cannot be justified in light of the minimal health threat posed by the material as long as it remains in place.

(2) Asphalt Shielding: Very high cost ($1,233,410); adequate protection of public health attributable mainly to the long-term controls required for any alternative that includes leaving some or all of the material in place; moderate to high reliability with long-term controls on excavation and maintenance activities; high feasibility.

(3) Limited Asphalt Shielding: Moderate cost ($87,418); adequate protection of public health; moderate reliability with long-term controls on excavation and maintenance activities; high feasibility.

(4) Modified No Action: Low initial cost ($30,000); adequate protection of public health; moderate reliability with long term controls on excavation and maintenance activities; moderate to high feasibility.

(5) No Action: No cost; slight risk to public health except if contamination is spread during excavation and maintenance activities potentially increasing public health risk; moderate to low reliability due to lack of controls on excavation/maintenance activities; high feasibility.

The selected remedy combines features of excavation and disposal and the Modified No Action Alternative. Initially the Modified No Action Alternative was the EPA preferred alternative. However, in response to concerns raised during the public comment period, the EPA amended the Modified No Action Alternative to recommend that the institutional controls also provide for the safe disposal of contaminated material removed during routine maintenance, repair, or construction activities in the affected streets.

Community Relations

The public comment period for the Denver Radium Site Streets was August 1, 1985 to August 22, 1985. The Feasibility Study and fact sheets were placed in several convenient repositories. The public was notified of the availability of these documents two weeks prior to the beginning of the public comment period through a display ad in both the Denver Post and the Rocky Mountain News. Press releases sent to community newspapers and newsletters resulted in news reports about the solicitation of public comments in the two major newspapers and on at least two TV and two radio stations.

No public meetings were held during the comment period because prior public meetings held by the Colorado Department of Health were sparsley attended and current citizen concern remains low. The EPA has met with some concerned citizens and has expressed willingness to meet with neighborhood groups or hold public meetings if the level of interest warrants it.

Most residents and property owners on the affected streets who commented during and after the comment period expressed the preference that the material be excavated and disposed at an approved facility. Some government agencies voiced concerns about possible risks associated with street and utility repairs and the need for more vigorous institutional controls, in particular, provisions for the notification and monitoring of street and utility work and for the disposal of contaminated material as it is encountered during routine maintenance, repair, or construction activities in the streets. In response to the public comments, the EPA developed the selected remedy which recommends that institutional controls provide for the safe disposal of contaminated material removed during routine excavation and maintenance activities in the affected streets.

Consistency With Other Environmental Laws

The standards for "Remedial Action at Inactive Uranium Processing Sites," 40 CFR Part 192, serve as both the initiator and the goal of the remedial actions at the Denver Radium Site. For properties contaminated with uranium or radium processing residues, these standards establish limits for the gamma radiation level and the annual average radon decay product concentration in any occupied or habitable building and for the concentration of radium in soil on open lands. Since the standards in 40 CFR Part 192 do not directly address the gamma exposure rate in outdoor, contaminated areas, the relevant and appropriate standard is 40 CFR Section 192.12(a) which specifies the maximum allowable radium concentration in the near-surface soil. In order to comply with 40 CFR Section 192.12(a), remedial actions shall be conducted when the concentration of radium in land averaged over any area of 100 square meters exceeds the background level by more than 5 picocuries of radium per gram soil in the upper 15 centimeters of the surface.

Only total excavation would satisfy this standard. However, the Total Excavation Alternative was eliminated in the initial screening because the cost of implementing this alternative far exceeds the cost of other alternatives without providing substantially greater public health or environmental protection. In certain circumstances, 40 CFR Part 192 provides that supplemental standards may be invoked. See 40 CFR Sections 192.21 and 192.22. Supplemental standards are appropriate when:

> "The estimated cost of remedial action to satisfy 40 CFR Section 192.12(a) at a ...site...is unreasonably high relative to the long-term benefits, and the residual radioactive materials do not pose a clear present or future hazard. The likelihood that buildings will

be erected or that people will spend long periods of time at such a vicinity site should be considered in evaluating this hazard. Remedial action will generally not be necessary where residual radioactive materials have been placed semi-permanently in a location where site-specific factors limit their hazard and from which they are costly or difficult to remove, or where only minor quantities of residual radioactive materials are involved. Examples are residual radioactive materials under hard surface public roads and sidewalks, around public sewer lines, or in fence post foundations."

40 CFR Section 192.21(c).

If a supplemental standard is applied, the implementing agency must select and perform remedial actions that come as close to the otherwise pertinent standard as is reasonable under the circumstances. 40 CFR Section 192.22(a). All of the alternatives remaining after initial screening, including No Action, fully comply with these supplemental standards.

The following are other Federal criteria, advisories, guidances and State standards which were considered when developing the selected remedy:

(1) Colorado Department of Health, Rules and Regulations Pertaining to Radiation Control. CRS 25-11-101 et seq. and implementing regulations.

(2) FRC, ICRP, and NCRP Guidelines.

The radioactive material is not, at present, licensed by the Nuclear Regulatory Commission (NRC) or the State of Colorado. However, if the material is used in a way that presents a hazard to human health, it becomes subject to the control of the Colorado Department of Health. The EPA Region VIII will take steps to ensure that disposal of any contaminated material removed during routine maintenance, repair, or construction activities is consistent with the EPA's off-site disposal policy.

Selected Remedy

The EPA selected remedy combines features of excavation and disposal with the Modified No Action Alternative. The selected remedy meets the supplemental standards for "Remedial Action at Inactive Uranium Processing Sites" which were chosen as the goal of remedial actions at the Denver Radium Site. The selected remedy is a cost-effective remedial alternative that effectively mitigates and minimizes threats to and provides adequate protection of public health, welfare and the environment. The costs of the other alternatives are not justified in light of the marginal reduction in risk they would provide.

The estimated initial cost of the remedy is $30,000. This includes the cost of studying and then establishing the institutional controls which would monitor all construction and utility work in the affected streets. Since the streets were owned by a subdivision of the State of Colorado at the time of disposal, the State is responsible for 50% of the capital cost. A possible funding mechanism for the State is its Solid Waste Tax Fund or the cost share credit claimed by the State for its site-related activities between January 1, 1978 and December 11, 1980.

Operation and Maintenance

The operation and maintenance activities required to ensure the effectiveness of the remedy are (1) excavation controls and (2) recommended provisions for disposal of contaminated material removed during routine maintenance, repair, or construction activities in the streets. These activities will continue for an indefinite time. The EPA has determined that the State of Colorado or subdivision thereof such as the City and County of Denver should be responsible for all operation and maintenance costs including the costs of the ongoing program to dispose of contaminated material removed during street excavations. The annual operation and maintenance cost (non-EPA funded) will vary depending upon the amount of material excavated during any particular year.

Schedule

Project implementation dates cannot be scheduled at this time due to the CERCLA program slowdown. Once the slowdown is lifted, the following key milestones will be scheduled:

- Start the design of institutional controls
- Complete the Design of institutional controls
- Selection of either a temporary storage or permanent disposal site
- Implementation of improved institutional controls

Future Actions

The future remedial activities that are required to complete site response are:

(1) Design of institutional controls: A detailed analysis of the required activities to establish improved institutional controls must be completed.

(2) Selection of a disposal facility: A facility must be selected for the proper disposal of any contaminated material removed during normal maintenance and repair activities in the streets. The State of Colorado is responsible for selecting a site for the permanent disposal of the Denver Radium material. Until this decision is made, the State may opt to use a temporary storage/staging area. EPA may, pursuant to CERCLA Section 111(a), help the State fulfill its CERCLA obligation to assure the availability of a disposal site (CERCLA Section 104(c)(3)(C)(ii)) by sharing in the State's capital expenditures for a disposal site for the Denver Radium material.

COMMUNITY RELATIONS RESPONSIVENESS SUMMARY
DENVER RADIUM SITE--OPERABLE UNIT 7 (STREETS)

January 13, 1986 U.S. EPA Region VIII

INTRODUCTION

This Responsiveness Summary was prepared to accompany the Record of Decision announcing EPA's selection of remedial action for the Denver Radium Streets, Operable Unit 7 of the Denver Radium Site. The Denver Radium Site consists of 11 property groups, each considered as a separate operable unit for the purpose of investigation and remedial action under Superfund. EPA conducted a Remedial Investigation of the Denver Radium Streets and prepared a draft Feasibility Study and Endangerment Assessment for Operable Unit 7, which was released July 25, 1985.

BACKGROUND

The Denver Radium Streets (Operable Unit 7) consist of nine street segments, totalling approximately 45 blocks in the Denver Metropolitan area. One segment is located in the northern part of the central business district, while the remaining eight segments are located in the vicinity of Cheesman Park, an urban residential area with some commercial and institutional establishments.

The Remedial Investigation for Operable Unit 7 consisted of field surveys to determine the level of radioactivity at street level, and borings to determine the location and vertical extent of contamination. The results showed that the radioactive contamination is contained in a layer of material at a depth of about 6 inches under the roadbed, and is entirely confined to the paved street area.

The Feasibility Study (FS) identified a range of possible remedial actions, and evaluated them based on technical feasibility, cost, and extent of environmental or health protection each would provide. An Endangerment Assessment evaluated the risks associated with the existing exposure levels and the long-term effects from taking no action. It was concluded that the radioactivity present in the streets does not exceed the recommended limits for general public exposure, and that standing at the "hottest" location for 16 hours a day for an entire year would result in only two-thirds the maximum recommended exposure for general public health. Most of the street areas showed much lower levels. Since the asphalt pavement offers a degree of shielding, there is little risk if the material is left in place. A greater risk may result from excavation and removal of the material, resulting in exposure through other pathways.

Three categories of potential remedial actions were considered: removal and disposal of contaminated material; radiation shielding with appropriate materials; and other alternatives including no action, area exclusion, and institutional controls. Based on these categories, five remedial alternatives were developed and evaluated in detail in the Feasibility Study. The alternatives were:

(1) Limited Excavation and Disposal:

Excavation of 194 cubic yards of contaminated material found within 4,600 square feet of the most contaminated street segments, with removal and disposal of the material at an EPA-approved facility for radioactive waste. Total cost of this alternative was estimated at $148,050.

(2) Asphalt Shielding:

Shielding to reduce gamma radiation by placing asphalt pavement over portions of the streets that are most contaminated, based on readings of gamma radiation. Approximately 36 percent of the total street area would be paved, with about 295,000 square feet receiving 3 inches of asphalt, and 6,000 square feet receiving 5 inches. Total cost estimate: $1,233,410.

(3) Limited Asphalt Shielding:

Limited shielding of 8,025 square feet of the streets by overlaying with a layer of 2 inches of asphalt. Total cost estimate: $87,418.

(4) Modified No Action:

Leave material in place; establish institutional controls and perform monitoring of all construction and utility work in the streets. Total cost estimate: $30,000.

(5) No Action:

Leave material in place; maintain at present level the monitoring of all construction and utility work in the streets.

As long as contamination exposed during street excavation is properly handled, any of the five alternatives would satisfy the applicable or relevant and appropriate environmental regulations and health standards and would maintain the gamma exposure below the maximum recommended levels for the general public.

The Asphalt Shielding Alternative is the most costly, but reduces the gamma exposure to the lowest level of the five alternatives. The contaminated material would remain in

place, however, with a possibility of exposure due to future excavations or utility work.

The Limited Excavation and Disposal Alternative would minimize future exposure to residents, users, and street workers. However, it requires the availability of a disposal site for the material that is removed, and might temporarily increase the hazards to residents and workers associated with removing and disposing of the contaminated material.

The Limited Asphalt Shielding Alternative would reduce the level of gamma exposure to about the same degree as the Limited Excavation and Disposal Alternative, but would leave the material in place.

The Modified No Action Alternative would leave the streets intact with no shielding and would not reduce current levels of radioactive exposure, but protection from unnecessary exposure would be provided by the enforcement of strict institutional controls.

The No Action Alternative would leave the streets intact with no shielding and would not reduce the current levels of radioactive exposure. The Denver Public Health Engineering Department would continue monitoring gamma radiation levels during any excavation in the streets.

As described in the Endangerment Assessment contained in the Feasibility Study, the existing level of gamma radiation does not exceed the maximum recommended exposure for the general public. Since all five alternatives maintain exposure levels below recommended limits and satisfy legal and environmental requirements, EPA considered the Modified No Action Alternative to be the most cost-effective remedy for Operable Unit 7.

The selected remedy is a combination of the Limited Excavation and Disposal and the Modified No Action Alternatives. Initially, the Modified No Action Alternative was the EPA-preferred alternative. However, in response to concerns raised during the public comment period, the EPA amended the Modified No Action Alternative to provide for the safe disposal of construction activities in the affected streets.

ACTIVITIES CONDUCTED BY EPA TO INFORM THE PUBLIC OF THE REMEDIAL ALTERNATIVES

The public comment period for the Operable Unit 7 Feasibility Study (FS) was held from August 1 through August 22, 1985. It was announced in a display ad placed in the Denver Post and the Rocky Mountain News two weeks prior to August 1. EPA also prepared a press release announcing the public comment period, identifying the Denver Radium Streets, and announcing the availability of the FS report and fact sheets.

The press release was sent to the Denver Post, the Rocky Mountain News, Westword, Life on Capitol Hill, and the Washington Park Profile. The latter two are local community publications. In addition, 650 copies of the press release were included as inserts in the Urban Dweller, a newsletter mailed to members of the Capitol Hill United Neighborhoods Association.

The study documents were placed in public repositories established at the EPA Library, the Denver Public Library, the Colorado Department of Health, and the Capitol Hill Community Center. A general fact sheet discussing the Denver Radium Site and a supplemental fact sheet summarizing the remedial alternatives for Operable Unit 7 were prepared. Copies of the documents were distributed to the repositories and the fact sheets were mailed to individuals and groups on the Denver Radium mailing list. As a result of EPA's activities, media interest led to news reports on two local TV stations (KCNC Channel 4 and KWGN Channel 2) and local radio stations (KIMN and KOA) at the start of the public comment period. Channel 2 and the Denver Post also did followup stories on the closing day of the comment period.

CONCERNS RAISED DURING REMEDIAL PLANNING PHASE

During the remedial investigation of Operable Unit 7, residents and property owners on the affected streets voiced few specific concerns. However, some government agencies raised concerns about possible risks associated with street construction or utility repairs. Following incidents in which street work was undertaken on Denver Radium Streets without workers being aware of the contamination, officials realized the need for better control measures. Provisions for notification and monitoring of street work were subsequently established by the City and County of Denver, but City, State, and EPA officials have continued to voice the need for establishing more rigorous institutional controls, which is reflected in EPA's choice of a remedy.

CONCERNS RAISED DURING THE FEASIBILITY STUDY COMMENT PERIOD

Fifteen written comments were received during the Feasibility Study public comment period. Nine letters were sent by affected residents and other concerned citizens, and a petition was signed by 12 residents of one of the Denver Radium Street blocks. One letter was sent by an environmental group, and a local energy firm sent a letter soliciting radon monitoring services. The City and County of Denver, the Colorado Department of Health, and the Department of Energy also submitted comments. Copies of all the written comments sent to EPA are attached to this Responsiveness Summary, and the letters are referenced by number in the following discussion.

The alternatives preferred by the commentors are as follows:

Excavation and Disposal	-	7
Shielding/Repaving	-	3
Leave Intact/Institutional Controls	-	4

One letter (No. 10) did not express a preference, but raised questions concerning the development and evaluation of the alternatives, and other related issues.

The issues raised, the level of concern expressed, the number of commentors mentioning each issue, and EPA's responses are summarized below. The following discussion represents EPA's response to the individuals and groups that submitted comments. Also attached is an errata sheet with corrections to the Feasibility Study report. EPA's responses to the detailed technical comments submitted by the other agencies are not contained in this responsiveness summary; rather, they are addressed as corrections shown on the errata sheet or they will be addressed in the Feasibility Study process for other Denver Radium Operable Units.

General Concern About Radioactive and Hazardous Waste

Comment: One letter (No. 1) expressed general outrage about the presence of radioactive materials at the Denver Radium Site as well as at the Rocky Flats nuclear weapons plant and in uranium mill tailings. The writer also questioned the possible presence of radioactivity in streets in Boulder, Colorado Springs, or Denver suburban areas.

Response: EPA indicated that the Rocky Flats Plant is on the National Priorities List and is being studied as a separate Superfund site. The uranium mill tailings are being dealt with by the Department of Energy under the Uranium Mill Tailings Remedial Action Program. Other municipal streets in Denver and Boulder have been investigated with no radioactivity found. The Colorado Springs area has not been investigated because there is no evidence that radioactive materials were processed in that area.

Public Notification and Provision of Information

Comment: One letter (No. 10) expressed concern about EPA's provisions for notifying affected residents about the public comment period and providing information about the remedial alternatives. The commentor felt that each resident should have been directly notified and that an open forum (meeting) should have been provided. The same commentor also felt

that the fact sheet did not provide sufficient information about the technical aspects of the remedies.

Response: As described above, EPA pursued several avenues to notify the general public, as well as residents of the affected area about the Operable Unit 7 public comment period and the availability of information about the remedial alternatives. EPA felt that it was not necessary to send notices to every addressee, and that the 650 notices mailed with the Capitol Hill United Neighborhoods newsletter would adequately notify area residents.

EPA has met with concerned individuals and upon request would be willing to meet with neighborhood groups or hold public meetings if the level of interest or concern warrants it. Prior meetings held by the Department of Health were sparsely attended, and minimal interest has been expressed in site activities.

The fact sheets prepared by EPA are intended to provide general information about site activities, nontechnical summaries of the results, and the remedial alternatives. They also announce the availability of the technical study documents in the public repositories.

Technical study documents contain executive summaries, as well as detailed discussion of the technical information. EPA will continue to assure that the public has access to them in the repositories. In addition, EPA will provide copies of the executive summaries of future Denver Radium RI/FS documents directly to anyone requesting them.

Comment: The Colorado Department of Health (CDH) (No. 5) expressed concern about the amount of time for their review of the Feasibility Study document prior to public release.

Response: An earlier draft of the document was submitted to CDH for review and EPA considered these comments when revising the FS. Under the Management Assistance Cooperative Agreement between CDH and EPA, all Feasibility Studies and other major Denver Radium documents that have not already been provided for State review will be furnished to the State in advance of release.

Degree of Risk Associated with the Denver Radium Streets

Comment: One letter (No. 3) was received from a long-time resident on one of the streets who felt that there is no threat to human health and that EPA should leave the streets alone. However, six other commentors (Nos. 1, 2, 8, 9, 11 and 13) expressed considerable concern about exposure to radioactivity if no action was taken or if excavation or street repairs are done. These individuals felt that any amount of radioactive contamination warrants excavation and removal to prevent exposure.

Two letters (No. 2, 10) questioned the level or dose of radioactivity and the standards that are applied. Two writers (Nos. 9, 10) expressed concern about the cumulative effects of continued exposure to any amount of radioactivity and one (No. 9), who also spoke directly with an EPA representative, questioned the risk compared to other types or sources of radioactive exposure.

Response: These questions are addressed in EPA's Endangerment Assessment, as part of the Feasibility Study for Operable Unit 7. The levels of radioactivity measured on the streets during the field work was assessed and compared to the guidelines that establish maximum recommended limits to the general public for lifetime exposure. Information was provided about the level of risk associated with long-term exposure in the area where the highest readings occurred, and showed that levels were within the guidelines. Commentors are referred to the Endangerment Assessment for a detailed discussion. The results of the Streets investigation showed that the contamination and exposure levels do not justify complete excavation and disposal.

Comment: A related issue was raised concerning the detection of the radioactivity (No. 13). The writer felt that if the levels were high enough to be detected even though the streets have probably been repaved several times, then there must be a risk that would not be eliminated by covering the streets.

Response: This is explained by the sensitivity of the instruments used in EPA's investigations. The instruments can detect even small changes in natural background radioactivity and can detect levels of radioactivity significantly below levels thought to pose a significant health risk.

Comment: Another writer (No. 6) expressed "moderate" concern about the radioactivity unless digging or street work takes place. This letter reported that when some work was done on a Denver Radium street last year, the authorities were not notified and no precautions were taken. The commentor raised questions about risk to the street workers, and about potential exposure due to potholes in the contaminated streets.

Response: EPA encourages anyone observing such conditions to immediately notify the City and County of Denver, Department of Health and Hospitals (893-6241), which has responsibility for monitoring street work. The City has already established a permit/notification requirement for utility and street work involving excavation on the affected streets. EPA's recommended remedial action will augment the current requirements and establish more rigorous control and monitoring systems.

Availability of Disposal Site

Comment: Three commentors (Nos. 5, 6, and 13) referred to the availability of a suitable disposal site if material is removed from the streets. One commentor (No. 2) referred to the EPA requirement to dispose of radioactive hospital wastes, and questioned why other radioactive material, such as that found in streets, could be left in place.

Response: EPA responds that hospital wastes come under more stringent requirements because they are often much more radioactive than the material in the streets and are usually in forms that offer a much greater chance for human exposure.

Comment: Two commentors (Nos. 6 and 13) were in favor of removal, but were concerned about the availability of a disposal site. One questioned the cost of disposal and who would bear it, while the other (No. 13) encouraged the State and EPA to work together to establish a disposal site.

Response: EPA acknowledges the need for a disposal site, which is the legal obligation of the State. Since Colorado does not currently have a disposal facility for radioactive waste, EPA is studying disposal options for any material that may be removed from the Denver Radium Sites. The Disposal Site Study is intended to assist the State in fulfilling its obligation to provide a disposal site for Superfund wastes. EPA will announce the availability

of the study for public review. The preliminary conclusions that may be drawn from the study are that the options for immediate disposal are extremely costly, and other options will probably not be available for at least 3 years. For these and other reasons, EPA feels that the excavation and disposal alternative is not a cost-effective solution for the Denver Radium Streets at the present time.

Comment: Comments received from the Colorado Department of Health (No. 5) suggest gradual excavation and removal of the material as future street work is carried out. The State further suggests establishing a fund to provide for the cost of such activities.

Response: EPA believes that such a remedy is appropriate, but would have to be implemented by the State and/or City/County of Denver since funding for ongoing or future maintenance activities falls outside the Superfund program.

In arriving at its final selection of a remedy, EPA has also considered the costs of immediate versus gradual excavation/disposal as they may affect other agencies or individuals. Immediate excavation/disposal (Limited Excavation Disposal Alternative) would cost approximately $150,000 and provide no material health and safety advantages over "no action." Since the streets are City property, the costs of remedial action would be allocated 50 percent to Superfund and 50 percent to the State, as provided by CERCLA. The State in turn may pass the cost on to the City and eventually some cost burden may be borne by property owners. However, the health and safety benefits of better controls on excavation could be improved by providing a safe method to dispose of contaminated material found during excavations. Therefore, EPA has added a provision for this in its selection of a remedy.

Effectiveness of Institutional Controls and Monitoring

Comment: Concern about controlling excavations and monitoring street work was expressed by two private citizens (Nos. 2, 6), by the City and County of Denver (No. 4), and by the Colorado Department of Health (No. 5). One commentor (No. 2) felt that control of private contractors would be difficult, and future street administrators would need to prevent

digging up the streets for repaving. Another writer (No. 6) felt that covering the streets would do little good if excavations were often taking place, and questioned how this could be controlled. The Department of Health (No. 5) cited the "difficulty of maintaining institutional control" and emphasized the need for a formal mechanism within the City and County of Denver to ensure control.

Response: EPA recognizes the need to establish strong institutional controls for notification and monitoring of work on the Denver Radium streets. This was the focal point of EPA's preferred alternative. EPA is aware that the present system has not always worked well in the past. Furthermore, the Agency recognizes that effective controls on excavation would be necessary even if shielding or partial excavation were implemented.

EPA believes that institutional controls are necessary to prevent inadvertent exposure and to ensure that any contaminated material that may be removed in the course of future street work is identified. With joint participation of all the involved agencies, EPA believes that an effective system can be established. EPA assistance will be made available to the City/County in devising appropriate systems for this purpose.

CONCLUSION

The foregoing summary indicates the nature of the comments received during the August 1-22 public comment period and the issues raised regarding the remedial alternatives considered for Operable Unit 7 (Streets) of the Denver Radium Site. EPA has taken the comments and recommendations into consideration, and its responses are summarized here. Based on the comments received during the public comment period, EPA amended the recommended remedy to include provisions for safe disposal of contaminated material exposed during street excavation and repair. However, because the type of excavation and disposal program recommended is largely a street maintenance activity, implementation of this remedy is primarily the responsibility of the City and County of Denver and the State of Colorado. On balance, this remedy is intended to satisfy the concerns of proponents of excavation and disposal without the adverse impacts of the costs and disruption that would accompany a major short-term program of excavation and disposal. Since the contamination present in the streets poses no significant health threat as long as it remains in place or is properly disposed of once excavated, the remedy will be fully protective of public health and the

environment as well as being cost-effective. Further details on EPA's decision and the justification for its choice of remedial action are provided in the accompanying Record of Decision.

DE/DENRD5/046

ERRATA
DRAFT FEASIBILITY STUDY
STREETS, DENVER RADIUM SITE
JULY 26, 1985

Page No.	Paragraph and Line Number(s)	Alterations
ii	3, 3	Should read "9th Avenue from Ogden Street to Cheesman Park"
iii	1, 4	Should read "Lafayette Street from 1st Avenue to 9th Avenue"
iii	1, 5	Should read "Marion Street from 6th Avenue to 9th Avenue"
iv	2, 1	Should read "...potential remedial actions..."
iv	3, 1	Should read "These remedial action alternatives..."
ix	Table	Table 2-1 should be labeled "Denver Radium Streets, Possible Remedial Actions"
ix	Table	Table 3-4 should be labeled "Rejected Alternatives, Denver Radium Streets"
1-1	2, 1 & 2	Should read "...remedial action alternatives..."
1-6	Figure 1-1	Identification of street segments should be made consistent with those on pages ii, iii, and on Figure 1-2.
1-7	Table 1-2	Title of table should read "Site Grouping, Denver Radium Sites"
1-8	3, 1	Paragraph heading should read "Denver Radium Streets." Replace "...Section 1.4" with "1.3."
1-10	Figure 1-2	Street No. 2: Change "York" to "Josephine Street" Street No. 3: Change "7th" to "9th" Avenue Street No. 4: Change "10th" to "9th" Avenue Street No. 5: Map should indicate segment and key should read "Humboldt Street from 7th Avenue to 9th Avenue" Street No. 6: Change "Downing" to "Cheesman Park" Street No. 7: Change "Stout" to "California Street" (Also note: same changes apply to map on Group 7: Streets Fact Sheet Supplement, August 1985)

ERRATA
(continued)

Page No.	Paragraph and Line Number(s)	Alterations
1-16	2, 13	Replace "Figure 1-2" with "1-3."
1-17	Table 1-4	For Boring No. 2, Contamination Depth is 12"; Pavement Depth is 10". For Boring No. 3, Contamination Depth is "10". For Boring No. 12, Contamination Depth is 6".
2-1	3, 2	Should read "...Denver Radium Streets."
2-1	5, 4	Should read "...(e.g. by an order of magnitude)..."
3-1	heading	Should read "Chapter 3"
3-1	1, 1	Should read "The remedial action alternatives..."
3-7	2, 10	Should read "...asphalt or regular..."
3-12	Table 3-4	Heading should read "Rejected Alternatives, Denver Radium Streets"
4-4	2, 4	Should read "...(Baker, et al., 1984)."
4-9	3, 4	Should read "... maximum gamma of 57 μR/hr."
4-12	Table 4-4	The total cost for Raising Manholes should be $300. Total cost for the limited shielding alternative is changed to $84,718. (Due to the relative cost of this change compared to the other alternative estimates, this total will not affect the cost evaluation of the alternatives.)
5-1	Table 5-1	Change Limited Shield Capital Cost to $84,718.
7-2	1, 1	Change "2 feet" to "3 feet"
7-3	5, 1	Responses to Comments are provided in a separate Responsiveness Summary to be attached to the Record of Decision.
8-1	2, 5	Should read "...exposure limit of 500 mrems per year for non-occupationally exposed individual members of the general population."

ERRATA
(continued)

Page No.	Paragraph and Line Number(s)	Alterations
Appendix A		
3-3	3, 9	Should read "...(80,000 and 1,620 years, respectively),..."

References Section

Add the following references:

National Regulatory Commission, 1983, Standards for Protection Against Radiation (10 CFR 20), 25 FR 10914, September 28, 1983.

EPA, 1982, National Contingency Plan, National Oil and Hazardous Substances Contingency Plan (40 CFR 300), [SWH-FRL 2163-4], July 16, 1982.

Baker, E.G., Hartley, J.N., and Freemen, H.D., 1984, Asphalt Emulsion Radon Barrier Systems for Uranium Mill Tailings--A Summary of the Technology, presented at the Sixth Annual Symposium on Uranium Mill Tailings Management, Fort Collins, Colorado, February 1 through 3, 1984.

7/31

Environmental Protection Agency
Office of Public Affairs
999 18th St. Suite 1300
Denver, CO. 80202

I am writing to express to you my outrage after reading in the Denver Post - 7/31/85 that 9 or so streets were radioactive. I want to see these sidewalks or streets dug up and properly disposed of. NOW!

I also demand a study to see if some of the streets in Boulder, or Colorado Springs or many of the suburbs of Denver are contaminated to.

I also believe that much of the front-range water is contaminated because of Rocky Flats and of toxic substance from industry. I absolutely demand the closure and permanent disposal of the plutonium infested Rocky Flats Plant. It is a crime against the people living in the Denver area to continually expose them (many without their knowing) to the most carcinogenic substance ever developed by man. Gilston

Reproduced from best available copy.

The DOE and Rockwell International ought to be prosecuted into the dirt for putting profit above people. Its like putting policy before principle. It doesn't work.

If the EPA is designed to protect the environment which includes its' people — then I suggest you get your ass in gear before the truth begins to reign down upon the insidious injustices that now exist.

I am also appalled in hearing of the massive uranium tailings that exist in the southern part of the state and within New Mex. & Arizona. Stop the madness. Stop it Now!

— Steve Jones
Environmentalist
Boulder, CO.

29

#2

Richard S. Snyder
1450 Columbine
Denver, CO 80206

August 1, 1985

EPA Office of Public Affairs
999 18th St., Suite 1300
Denver, CO 80202

Sirs:

This letter concerns Denver Post article of Wednesday, July 31, 1985, p.4A which detailed the radioactivity of certain streets in Denver. I and my family live very near some of these streets. The article also said the EPA solicited comments on the handling of the matter.

The first question that comes to mind is the nature of the radioactivity and the amount. If it is from radium, then quantitatively, in rads, what is the strength of the dose?

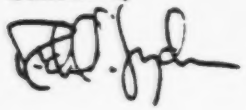
The second question concerns the law. I work at Porter Memorial Hospital, am a registered Medical Technologist, and am the Maintenance and Safety Supervisor for the laboratory. We are required, by the EPA, to dispose of even the smallest amount of long-lived radioactive substances through an authorized contractor who stores the material in a safe and approved manner. It seems that the streets are hardly a safe and approved disposal site for radium.

I think that controlling the excavation of the affected streets is virtually impossible. Nature does plenty of her own. Private plumbers carve their rectangular slabs out for retapping older homes' water lines into the city's main. Someone is going to have to keep track of these streets for the life of their radioactivity.

Raising the street level by paving over them doesn't seem to the the best solution. Again, someone is going to have to warn subseqent generation of road administrators that they can't rip up all the pavement to pour additional layers of paving, as is done now to prevent the level of the street from getting out of hand.

It seems like the only good long-term choice is "Digging up, removing and disposing of the contaminated asphalt," to quote the Post article. The Superfund should be able to handle that—it's hardly in the same league with the Rocky Mountain Arsenal.

Concernd,



20

#3

Denver, Colo., Aug. 8, 1985

Office of Public Affairs,
Environmental Protection Agency,
999 18th Street,
Denver, Colo.

Sirs:

In reply to an article published in the Denver Post a few days ago, I would like to advise you as follows:

In March 1942 I purchased the house at 925 Lafayette Street, Denver, and have made it my home ever since that date. The radio active "contamination" in the streets in front of and asound my home has never bothered me in the least - I am in perfect health at 92 years of age and am completely satisfied with out neighborhood as it is. I think it would be absolute nonsense for you to dig up all the streets in this neighborhood where "contaminated" was spread to cover the tramway rails when the steeet cars were abandoned.

dig it

Why can't we live in peace and you spend your money on projects where contamination of one kind or another in really harmful to living things?

Sincerely
Jean Leslie
Jean Leslie
925 Lafayette
Denver, Colo. 80218

1985 AUG -9 PM 1:16

Reproduced from
best available copy.

Federico Peña
MAYOR

City and County of Denver
CITY AND COUNTY BUILDING • DENVER, COLORADO • 80202
TELEPHONE (303) 575-2721

COMMENTS OF THE CITY & COUNTY OF DENVER
ON
EPA PROPOSALS FOR DENVER RADIOACTIVE STREETS

AUGUST 9, 1985

The City & County of Denver and its Department of Health & Hospitals are concerned about the mill tailings from radium processing that have been mixed with asphalt and utilized in paving certain parts of Denver's streets. Continuous monitoring by the City and EPA show that radiation levels have remained constant since 1979. The levels are very low and do not present a health hazard to Denver residents, even those living adjacent to the contaminated streets.

We are concerned that an attempt to excavate the radioactive materials may expose residents to a greater health danger. Any unnecessary release of radiation should be avoided.

For this reason, and the high cost involved in removal and disposal, it would be our recommendation that the streets involved be overlaid with a new asphalt coating which would eliminate any potential hazard from this material. The limited resources available will be better spent cleaning up some of the other radium sites. We look forward to action on the remaining radium sites.

Thank you for inviting comments on this health concern.

Tony Massaro
Director of Environment Affairs

RECEIVED
AUG 22 1985
Superfund
Remedial Branch

hand delivered
2:45 pm

32

#5

COLORADO DEPARTMENT OF HEALTH

Richard D. Lamm
Governor

Thomas M. Vernon, M.D.
Executive Director

August 12, 1985

John Brink, Remedial Project Manager
Superfund Branch
U.S. Environmental Protection Agency
One Denver Place
Denver, Colorado 80202-2413

RE: Denver Radium Streets Feasibility Study

Dear Mr. Brink:

Enclosed are our general comments to Mr. Duprey, and our detailed comments for your use. It would have been better if we could have reviewed an in-house draft of this document before it went public so that a lot of these minor items and typos could have been cleared up first. We suggest that Tom Stauch at Denver Public Health Engineering also be afforded that same opportunity.

With respect to comments 3 and 18, although the extremely conservative approach to exposure calculation used here may serve satisfactorily for comparing options, it can give a very misleading impression if taken on an absolute basis.

We look forward to your scheduling a joint meeting with the City of Denver officials after the close of the comment period.

Sincerely,

Albert J. Hazle, Director
Radiation Control Division

AJH/RG/ms

Enclosures

cc: T. Peabody
R. Duprey
T. Looby
C. Sutton

4210 EAST 11TH AVENUE DENVER COLORADO 80220 PHONE (303) 320-8333

33

COLORADO DEPARTMENT OF HEALTH

Richard D. Lamm
Governor

Thomas M. Vernon, M.D.
Executive Director

August 13, 1985

Robert Duprey, Director
Air & Waste Management Division
U.S. Environmental Protection Agency
One Denver Place, Suite 1300
999 18th Street
Denver, CO 80202-2413

RE: Denver Radium Streets Feasibility Study (7-25-85)

Dear Mr. Duprey:

This July 25, 1985 version of the feasibility study is much improved over the March 7, 1984 version. Under separate cover we are providing John Brink with detailed comments; we offer here only several general comments as noted below. I would like to emphasize again the need for adequate time for the State to review these documents before their public action. This feasibility study was announced to the public before we saw a copy of it.

The principal concern with the radioactive materials under the Denver streets is the potential for loss of control and misuse as has happened with similar materials in Grand Junction and elsewhere. The difficulty of maintaining institutional control over this kind of location has already been made evident in Grand Junction and in Denver during the last five years. Although we are not aware of any misuse of the Denver street material since its discovery in 1979 we are acutely aware of gaps in institutional control.

The hazard of the contamination in its present location is not great enough to justify the cost of its immediate removal under the program. As long as the contamination is in the streets however, there is a potential for its uncontrolled removal and inadvertent use under or near structures. This could generate a definite indoor radon hazard.

We suggest therefore two general approaches to prevent future problems: First there needs to be established within Denver City Government a much more formal mechanism for controlling interaction with these materials on the part of street and utility workers. Second, a fund and disposal facility needs to be set aside so that in the future contaminated material can be properly disposed of when it is dug into or removed during the course of normal repair or repaving activities. We would anticipate that during a hundred year timeframe complete reconstruction of the road bed would be accomplished and the contamination would have been removed.

It is our understanding that the Denver authorities share these views and that our three organizations can arrive at a mutually acceptable solution.

Sincerely,

Tom Looby

Thomas P. Looby
Remedial Programs Director

cc: Tom Peabody, DH&H

Enclosures

4210 EAST 11TH AVENUE DENVER,COLORADO 80220 PHONE (303) 320-8333

Radiation Control Division

34

INTER-OFFICE COMMUNICATION

TO: Denver Radium File

DATE: August 2, 1985

FROM: R. Gamewell

SUBJECT: EPA Feasibility Study - Denver Streets

Comment #	Page	Paragraph	Comment
1	iii	Table	Should make clear whether these are corrected readings.
2	1-16	2	The notification system to Denver Public Health Engineering has failed on occasion and needs strengthening.
3	1-16	2	The monitored excavations are in Fig. 1-3 not 1-2.
4	1-19	6	The likelihood of a person spending 16 hours a day for 365 days a year on a Denver Radium street is zero.
5	2-3	5	If the contamination were to get redistributed along utilities during the course of excavation and construction activities, the potential for a radon problem could arise.
6	2-6	3	Ibid.
7	3-1	3	Special pavement removal equipment is routinely used by the City of Denver. This might be particularly useful for the streets where the contamination appears to be in the lower layers of the pavement itself.
8	3-4	2	The principal concern with this kind of material is the potential for uncontrolled future relocation and inadvertent use under buildings. The difficulty of maintaining control in these locations is already evident in Denver and Grand Junction.

35

#5

Comment #	Page	Paragraph	Comment
9	3-7	2	Adding a layer of pavement could necessitate additional costs for raising gutters, curbs, sidewalks and drainages. Normal street repaving involves prior removal of the top layer to avoid excessive buildup.
10	3-8	last	Excessive cost is also a consideration with high density concrete.
11	3-10		An alternative which should be considered is the provision of a standby fund to cover future removal and disposal of materials excavated during normal street repair and repaving activities. Routine surficial repaving (top 4 inches) is done about every 5 to 10 years. At 25 year or longer intervals, depending on wear, deeper repaving including rebedding may be done. At that point in time there needs to be a repository and funding to take care of removed contamination.
12	4-2	3	One can't selectively repave portions of a street to different elevations. A block or more must be done completely. Because of impacts on drainage patterns, additional non-contaminated streets might have to be repaved.
13	4-4	4	See comment 8.
14	5-4	7	40 CFR 192 could also apply to a partial removal.
15	Ap A 3-3	3-	T-1/2 for Th^{230} is 80,000 years not 8000.
16	Ap A 6-3	Table 6-1	What is the applicability of these standards to this program? It should be pointed out that the CDH guidelines refer to the decontamination of facilities and equipment prior to release for unrestricted use.

#5

Reproduced from best available copy.

Comment #	Page	Paragraph	Comment
17	Ap A B-1	2	Typo - should read exposure limit of 500 rems.
18	B-2	2	The shorter time scenarios are still much too long for any reasonable exposure to workmen or commuters. However, conversion of the street to a mall such as the 16th Street Mall, could lead to a perceptable but still insignificant exposure for a street vendor. See comment 3 for the real exposure hazard for these materials.

37

#6

Joan Byrne
1515 East 7th Avenue
Denver Colorado 80218
377-5100

August 17, 1985

Dear Sir:

My concern about the radioactive material in our streets is moderate until digging takes place.

Wells are often being dug, frequently by private concerns doing work for individual homeowners. After such an incident last year, I learned that the proper authorities had not been notified, and the proper precautions had not been taken, especially for the young men who

#6

Joan Byrne
1515 East 7th Avenue
Denver, Colorado 80218
377-5100

spent the day or two digging.

Right now, there are not two type holes in Twentieth St. between 6th and 7th Avenues. Regardless of this & But the digging and situation? other holes concern me a fair amount.

As to the three alternatives digging up would be preferable but where would the materials be dumped and how would we pay for it."; covering dates with and when there were to be frequent

Reproduced from best available copy.

39

#6

Jean Byrne
1515 East 7th Avenue
Denver, Colorado 80218
377-5100

deep work, how can any excavation of the streets be controlled? I would like to know current procedures for excavation of these streets.

I appreciate your solicitation of comments.

Sincerely yours,
Jean Byrne

August 20

#7

Dear EPA -

In response to your request for comments about the proposals concerning the radioactive asphalt on Denver streets, particularly 11th Ave between Josephine & Cheesman Park, I urge that you cover the concerned streets with 3-5" of asphalt to reduce the gamma ray exposure. I urge that you not merely cover the "hot spots" with asphalt; nor that you continue to do nothing (that is, take no remedial action). I am very concerned about the health risks.

Eric Perryman

41

#8

Mark W. Tatge
1044 Downing St.
Apt. 302
Denver, CO 80218

Aug. 21, 1985

EPA
Office of Public Affairs
999 18th St.
Suite 1300
Denver, CO 80202

Dear Sir,

This is in response to your request of what to do about the radium tailings in my street.

I shouldn't really have to write this letter. The course of action should be obvious - dig it all up. That's what SuperFund is for.

Please don't tell me that the radium tailings are not harmful. I don't believe it. Nor am I as gullible as the sailors who watched the early nuclear tests at Bikini Islands with U.S. government assurance that it wasn't harmful.

So clean that mess on my street up and throw the people in jail that put it there.

Sincerely,

Mark W. Tatge

P.S. Please send me a complete report of what you intend to do so I know whether I should move or not.

#9

August 22, 1985

Environmental Protection Agency
Office of Public Affairs
999 18th Street, Suite 1300
Denver, Colorado 80202

Gentlemen:

With regard to the Superfund money allotted for cleanup of the Denver streets in the Capitol Hill area paved with asphalt mixed with uranium mine tailings:

Please don't pave over them. Please don't pretend that the problem will go away. Remove that stuff from our streets and dispose of it safely.

Most of us are aware that there are "acceptable" amounts of radiation...amounts we can and do absorb before any harm is done to our bodies. New technology has entered our society at a rapid pace through the work place, the environment and at home, and has brought with it an increased exposure to small doses of radioactivity. I think that agencies responsible for protecting the welfare of people in our society must do everything possible to eliminate unnecessary radioactive dangers wherever they occur.

Danger, it seems to me, lies as much in small amounts of radioactivity absorbed cumulatively as in large, isolated and well-publicized exposures.

Thank you for allowing me to express my opinions on this matter. I strongly urge you to consider them when a final decision is made.

Sincerely,

L. Carol Christopher

L. Carol Christopher
1424 E. Tenth Avenue, #7
Denver, CO 80218

Talked to 8/22
explained information -
She will write
Letter #3.

#10

FORTY-SECOND FLOOR
1801 CALIFORNIA STREET
DENVER, COLORADO 80202

August 22, 1985

Marilyn Null
U.S. EPA
Office of External Affairs
Suite 1300
999 Eighteenth Street
Denver, Colorado 80202

Re: Denver Radium Group 7-Streets

Dear Ms. Null:

I am a homeowner at 121 Lafayette Street. Having reviewed the July 1985 Superfund Program Fact Sheet and the August 1985 Fact Sheet Supplement, I am disturbed by a number of aspects of the Denver Radium Site program.

1. Notification and Public Comment. As there are only nine limited street segments involved, why has there been no attempt made to notify the residents of these streets as to the situation, the proposed remedies and the fact that they have the ability to have an input into the situation? It would seem rather simple to have mailed the applicable fact sheets to each of the involved property owners, as they are an easily identified group.

How can it be said that a "public comment period" exits when no attempt is made to communicate the existence of a problem to the limited easily identifiable group of residents affected and interested in making comments? Would it not be more appropriate, if public comment is truly desired, to notify each resident on the affected streets and to have an open forum for discussion of the three proposed alternatives?

2. The Three Remedial Alternatives. How can residents be expected to form any views as to the three alternatives mentioned in the Fact Sheet Supplement when no discussion of any type is provided therein with respect to these alternatives. Will the removal process produce higher short-term radiation levels? What will be the cost of removal and disposal and what are the factors that cause the EPA to determine it is not cost-effective? What factors were evaluated by the EPA in determining that leaving the radioactive material where it is, obviously the easiest

and cheapest alternative, is also the most cost-effective solution?

On the subject of cost-effectiveness I would simply raise the issue of how it is determined that the situation is so safe that cost-effectiveness is the appropriate test? When a rock climber, who has willingly and with full knowledge assumed the risks of his endeavor, is hanging onto a ledge in Rocky Mountain Park, is an auditor brought in to determine the cost-effectivness of using an Army helicopter to rescue him? Other similar "emergency" analogies abound. Should the fact that in such situations a life-threatening situation is clearly manifest, as opposed to an increased cancer risk manifesting itself over 20 or 30 years, be sufficient to allow the "no-cost" alternative of basically ignoring the street radium problem to become the "most cost-effective alternative."

3. How Much Radioactivity is There? This question is answered in the Supplemental Fact Sheet by stating that 16 hour a day exposure for an entire year would result in only "two-thirds the maximum exposure under federal standards." Are these standards for annual exposure, lifetime exposure or some other time period? Is there a cumulative effect of 30 years of exposure and is that factored into your calculations? How high must an increased cancer risk be before it becomes cost effective to remove radioactive material?

More importantly, why should unsuspecting residents bet their lives on being at two-thirds of current federal standards? Are these the same standards under which above-ground nuclear tests were permitted in the Western United States in the 1950s. The concept of "safe" amounts of radioactivity are still evolving and I for one am not reassured by being at the two-thirds level of today's maximum exposure standards. What is the increased cancer risk at the two-thirds level?

4. Conclusions. I do not believe the comments of concerned citizens have been adequately solicited as no attempt has been made to contact directly the residents of the affected streets. No adequate justification is presented in your written materials as to why leaving the radioactive materials in place is anything other than the cheapest solution. No adequate attempt has been made to explain the health risks to the affected residents. To simply state that the EPA considers one solution the most cost-effective and that radiation levels are at most two-thirds

#10

of current maximum federal standards, is not, in my opinion, an adequate discussion and give-and-take for a democratic system. Finally, why has the EPA not sought a public forum in which the questions raised in this letter and those of other concerned citizens can be answered?

Very truly yours,

Richard M. Russo

RMR/bmc

46

#11

FORTY-SECOND FLOOR
1801 CALIFORNIA STREET
DENVER, COLORADO 80202

August 22, 1985

Marilyn Null
U.S. EPA
Office of External Affairs
Suite 1300
999 Eighteenth Street
Denver, Colorado 80202

Re: Denver Radium Group 7-Streets

Dear Ms. Null:

Attached is a petition regarding the above-referenced situation signed by all of the residents of the 100 block of Lafayette Street who could be contacted during the last two days. I am certain similar petitions would be generated on other blocks, with signatures by an equally high percentage of residents, if a genuine attempt to notify all affected residents is made by your office.

Very truly yours,

Richard M. Russo

RMR/bmc
Enclosure

47

#11

Marilyn Null

U.S. EPA Office of External Affairs

999 18th St. Suite 1300

Denver, Colorado, 80202

Dear Ms. Null,

The undersigned are residents of the 100 block of Lafayette Street. Our street has been identified by the EPA as containing radium processing waste in subsurface asphalt and aggregate layers. We understand that three remedial measures are being considered, two of which involve leaving the contaminated materials in place. Leaving any contaminated materials in place is unacceptable to us. As strongly as possible we urge the EPA to remove and dispose of the contaminated material not only from Lafayette Street, but from all the streets in the Cheeseman Park area and upper downtown.'

You may correspond with us through:

Sally Russo

121 Lafayette St.

Denver, Co. 80218

Thank you for your attention to this matter.

We await your reply.

Sincerely

Name	Address		
1/2 Stephen Stockmar	127 Lafayette St.	Den. 80218	8/20/85
Rose Mary L. Ligge	163 Lafayette St.	Den. 80218	8/20/85

#11

48

Name	Address		
Sally Rago	121 Lafayette St.	Denver C	80218
Walter W. Golem	167 Lafayette	"	8/20
A K. Lewis	199 Lafayette	..	..
Susan B. Eldredge	188 Lafayette	Denver, CO	8.20-85
[illegible]	164 Lafayette	" "	..
[illegible]	Cuthawood 130	Lafayette	..
Jennie Barry	101 Lafayette	Denver	8/20/85
Todd McMillen	185 Lafayette	Den	80218
Sharon Elfenbein	170 Lafayette	Den	80218
Ann Lee	100 Lafayette	Denver	80218

APACHE ENERGY & MINERALS COMPANY
13131 WEST CEDAR DRIVE, LAKEWOOD, COLORADO 80228, (303) 988-3033

August 22, 1985

ENVIRONMENTAL PROTECTION AGENCY
Office of Public Affairs
999 18th Street, Suite 1300
Denver, Colorado 80202

RE: EPA Request for Comments on
Radioactive Asphalt in Designated Streets

Gentlemen:

Apache Energy & Minerals Company is in the business of measuring radon which is assumed to be the principle potential health hazard associated with radioactive asphalt, as it impacts on homes and work environments adjacent to the effected areas.

Based on Apache's knowledge and expertise, we support your preferred course of action of "leave the stuff where it is" and feel that this position could further be supported by selective measurements of the radon in adjacent structures. Additionally this approach would provide an additional saftey factor in that if there is an accumulation of radon in the adjacent structure, the situation could be remedied and corrected as it applies to that particular building, rather than the gross approach of tearing up the street and replacing it. It may or may not be the control factor to the control of the radon. Apache would propose to work with your organization on establishing a plan, in precise locations to accomplish such monitoring and further will provide all necessary support services to install, remove, and report the measurements.

For planning purposes, a cost of $50 per monitor is provided and the duration of the monitoring period is thirty days. The device we propose to use in conjunction with this monitoring is manufactured by Terradex Corporation and is readily available in the Denver region. Apache is the distributor for the monitoring device. This device and technology has been used previously in conjunction with EPA sponsored projects, and is more fully described in the enclosed brochure.

In the event you would like to further explore the possibility of utilizing Apache's knowledge and expertise in this field, please contact the undersigned at 988-3033.

Sincerely,

APACHE ENERGY & MINERALS COMPANY

R. Stanley Thompson,
President

#13

50

165 Marion Street
Denver, CO 80218
August 27, 1985

Marilyn Null
U.S. EPA, Office of External Affairs
999 18th Street, Suite 1300
Denver, CO 80202

Dear Marilyn:

I am writing to you regarding the proposed solutions to the radium problems in Denver that are being considered by the EPA.

In response to the EPA's Proposal #3 (No action; controls and monitoring of excavation activities), since the Denver radium sites are on the Federal priority list, I feel "no action" to be a total neglect of responsibility.

Regarding Proposal #2 (Shielding with a layer of asphalt or concrete), I have to believe that the streets in question have been resurfaced several times within the period from 1920 to the discovery of the radium in 1979. If resurfacing is such an effective shield, how did the EPA discover the hot spots in '79? Also, how does the EPA plan on handling the other properties, 1 thru 11, on the Denver radium property location key?

Proposal #1 (Excavation, removal, and offsite disposal of contaminated material), seems to be the safest, most feasible solution to the problem. Not only for the streets, but also for the remaining ten sites.

It is my understanding that the State of Colorado still does not have a contaminated materials dump site. I hope this is not the reasons for Proposals #2 and #3. I would encourage the EPA, the Colorado Department of Health and the State to work together to immediately establish a dump site so that once and for all all of the contaminated sites can be cleaned.

Sincerely,

James F. Schaefer

51

#14

Department of Energy
Post Office Box 2567
Grand Junction, Colorado 81502-2567

August 29, 1985

Superfund
Remedial Branch

RECEIVED
SEP 05 1985

Mr. Bob Duprey, Director
Air and Waste Management Division
U. S. Environmental Protection Agency
1860 Lincoln Street
Denver, CO 80295

Reference: (1) Technical Review of the Draft Feasibility Study for the Denver Radium Streets

Dear Mr. Duprey:

The Grand Junction Area Office is pleased to deliver our review of the above-referenced report pursuant to Interagency Agreement Number DW899309-65-01-0. If you have any questions on these reports, please call Mr. Larry Ball (FTS 322-9228) who is coordinating this work.

Very truly yours,

Merle E. Crew

Merle E. Crew
Manager

Enclosures
As stated

cc: w/enclosures:
John Brink - EPA

cc: w/o enclosures:
C. R. Nichols - ID
L. Ball - GJAO
M. Madson - BFEC

8-291tr/Ball1A

ALLIED Bendix Aerospace

Bendix Field Engineering Corporation
P. O. Box 1569
Grand Junction, CO 81502-1569
Telephone (303) 242-8621
Telex: 454-338

August 29, 1985

Mr. Larry Ball
U.S. Department of Energy
Grand Junction Projects Office
P.O. Box 2567
Grand Junction, CO 81502

Subject: Technical Review of the Draft Feasibility Study for the Denver Radium Streets

Dear Mr. Ball:

We are pleased to provide the Department of Energy and the Environmental Protection Agency with a Technical Review of the Draft Feasibility Study, Streets, Denver Radium Site 51-8M01.0 dated July 26, 1985. Bendix review comments as well as a "red-lined" copy of the study are attached. We will be pleased to expand on these comments should additional information be required.

With regards,

M E Madson

Michael E. Madson, Project Manager
UMTRA Program Division

Copy sent to Steve Tarlton 9-10-85

fwb 8/29/85

Technical Review of the DRAFT FEASIBILITY STUDY FOR THE DENVER RADIUM STREETS

INTRODUCTION

A preliminary draft of the Feasibility Study for Denver Radium Streets was submitted to Bendix Field Engineering Corporation for technical review in September 1984. That review specifically addressed health and safety, engineering, and radiologic assessment concerns and was submitted to EPA through DOE on October 5, 1984.

The current review was performed on the Draft Feasibility Study of July 1985 which emanated from the preliminary works of 1984. A team of reviewers within Bendix was assembled to provide professional experience and judgement to the review. The team members, and their respective areas of expertise, included: D. Emilia - overall technical review; D. Price - engineering and remedial action design; R. Murri - radiologic assessment; A. Tschaeche - health and safety; and M. Madson - overall technical review.

SUMMARY OF REVIEW

Particular attention was paid to defensibility of the Draft Feasibility Study from the perspective that the document will be made available for public review and commentary in the near future. Many of the Bendix reviewers comments, questions, and recommendations may also be identified by other individuals or agencies involved in the public review process. Bendix review comments address the following topics:

- The No Action Alternative
- Radiologic Assessment and Associated Data
- Engineering Data
- Report Organization and Presentation

The No Action Alternative

The No Action Alternative preferred by EPA is defensible; however, the reviewers have identified not only inconsistencies in application of the Standards for Remedial Action (40 CFR 192) but also paucity of data which demonstrate compliance with the standards.

Gamma radiation data reported for the streets are not pertinent to 40 CFR 192 (part 192.12) because gamma radiation levels apply only to occupied or habitable structures - an interior standard. Exterior gamma radiation criteria implemented in the UMTRA Program are discussed in the Vicinity Properties Management and Implementation Manual. (See VPMIM pages A-9 and A-10.)

Radium-226 data for the streets are applicable; and, the data presented in the study clearly demonstrate contamination to be in excess of the standard in 40 CFR 192.

No data are presented for radon decay product concentrations in structures along the streets. The Colorado Department of Health, particularly in the conduct of decontamination of vicinity properties in the Grand Junction area, continues to be conservative in its approach to this problem area. Radium concentrations in the streets may lead to increased working levels in structures several tens of feet distant from the identified contaminants. While the assumptions in the study, which state that radon migration into nearby structures is of low probability, may be valid, there are no data to support the assumptions. If contaminants are left in place, then the reviewers foresee a definite need for interior WL measurements to substantiate low risk in the environment. Measurements of annual average WL should be taken in a statistically significant number of structures according to current measurement protocols. (See two recommended additions to the References Section.)

NRC exposure-rate guidelines have been demonstrated to be in excess of the "worst-case" exposure-rate scenarios presented in the report and are acceptable with some reservations. Calculations in Appendix A are made of worst case annual doses to unspecified individuals who spend specified amounts of time per year on the contaminated streets. The calculated annual doses are then compared with the USNRC limit for annual doses in controlled areas (10 CFR 20.105) and found to be below that limit. The NRC in 10 CFR 20.1 (c) states "... persons ... should ... make every reasonable effort to maintain radiation exposures ... as low as is reasonably achievable". It may be unlikely that the NRC would grant a license to, or permit operations by, a licensee that would result in exposures to the general public of any but a small fraction of the 500 mrem per year. Accordingly, comparison of exposures at the Streets site with the NRC limit may not be appropriate. The current technology of risk assessment carries calculations of risk beyond exposures over time to hypothetical deaths or incidents of stochastic effects such as cancer. Accordingly, an assumption should be made of the number of individuals who may be exposed to the calculated annual dose. The annual number of person-rems should be calculated. Then the risk factors proposed by the BEIR Committee in 1980 should be applied to estimate the number of stochastic effects for a result against which the risk results of various remedial action alternatives could be compared. A more realistic calculation of annual doses could be made that takes into account average doses (not highest doses), shielding by vehicles, and doses to street maintenance personnel. Additionally, what could be the doses to individuals who some day will dig up the streets entirely for rapid transit construction or for some other purpose?

In addition to observance to NRC guidelines, the most viable justification to the No Action Alternative is contained in 40 CFR 192 (192.21 (c)). In this instance, supplemental standards could be applied if costs are unreasonably high relative to the long-term benefits and the residual radioactive materials do not pose a clear present or future hazard. Long-term benefits of the remedial action alternatives discussed in the study are not precisely addressed. A provision should be made in the final findings that if streets are reconstructed or if use is changed (e.g. structures built over the street land) that the contamination must be cleaned up and the site certified for unrestricted use before final reconstruction is completed.

Reproduced from
best available copy.

Radiologic Assessment and Associated Data

The inappropriateness of applying an indoor standard to the streets has been mentioned above. On pages 5-3 and 5-4 of the endangerment assessment the results of the EPA boring program are described. However, these measurements are not defined. How were they taken, what instruments were used, how were the instruments calibrated, and how were radium concentrations derived from gamma readings? Table 1-4 and Appendix A, Figure 5-2 do not agree with regard to contamination depths.

Engineering Data

The repetitive discussions of "Disposal Options" throughout the study are unnecessary. The problems associated with a viable disposal site apply to the entire Denver Radium Sites program, not just the Denver Radium Streets. Availability, or lack of availability, of a disposal site should be addressed in the Executive Summary and Introduction only. If a disposal site is available, then the transport costs (and associated health risks) are pertinent to remedial action alternatives for the Denver Radium Streets. Lack of a disposal site precludes any and all removal alternatives. The Feasibility Study should assume (as should be stated in the Executive summary) that appropriate disposal facilities will be available to the program.

Another area of confusion within the study concerns the concrete shielding alternatives. Some work should be done on the report to clarify the elimination of both conventional concrete and high-density concrete alternatives. This clarification would aide the readers in their understanding of the two alternatives.

Report Organization and Presentation

The following comments specifically address characteristics of the study in the areas of grammar, typographical errors, and consistency of statements or data presented within the draft. Also, I have attached a "red-lined" copy of the study for your inspection. Bendix would be pleased to confer with EPA on any of these specific recommendations.

page iv : Pluralization and grammar
page v : Recommended grammar
page vi : Recommended grammar
page vii : 3.2 title recommended to be "Radiation Shielding"
3.2.2 title recommended to be "Concrete Mixtures"
page viii : Appendix A should list chapter titles
page ix : Figure 3-1 should be altered to read Gamma "Radiation Intensity" ...
Table 1-3 should be "Levels of Gamma Radiation"
Table 2-1 should read Denver Radium Streets ..., not "Sites"
Table 3-4 should read "... Denver Radium Streets", not "Sites"
page 1-1 : Recommended grammar
page 1-3 : Radium processing outlined does not explain sulfate or bromine origin - is part of the explanation missing?

page 1-4 : Are CDH 1981 and 1982 reports published?, grammar
page 1-? : Should Figure 1-1 be numbered?
page 1-8 : 1.2 heading should not contain the word "SITE"
Missing reference on Arix Corporation report?
Units of measurement in Section 1.4 but there is no 1.4
page 1-? : Should Figure 1-2 be numbered?
page 1-? : No page number of Figure 1-3, "No Scale" statement should be in the legend - not the title.
page 1-16 : Tables 1-4 and Appendix 5-2 disagree. Monitored excavations are shown in Figure 1-3 (not 1-2). If public health monitoring confirms the absence of contaminant below the asphalt what about the 12, 16, and 18 inch depths mentioned in the next paragraph?
page 1-17 : Data do not agree with Appendix A, Figure 5.2
page 1-18 : Recommended grammar, 40 CFR 300.68 and 40 CFR 192 are not in the references.
page 1-19 : Recommended grammar
page 1-20 : Recommended grammar
page 2-1 : Recommended grammar
page 2-2 : Recommended grammar, recommendations about "Disposal Options" section contained in Table 2-1.
page 2-3 : 40 CFR 300.68 (h) is not in references, lack of data to support statements about risk from radon.
page 2-4 : Definition of "normal use" may not be appropriate, no cost data presented for on site disposal.
page 2-5 : Recommended grammar, inconsistencies with conventional vs. dense-mixture concretes.
page 2-6 : Recommended grammar in "ventilation" section, proposed revision to NCP seems out of place.
page 2-7 : Problems with "Disposal" alternatives and the fact that relevant regulations would be satisfied according to the Executive Summary.
page 3-1 : Chapter or Section 3?, recommended grammar, what is "contractor preference"?
page 3-2 : Concrete confusion again, what happened to "combinations of the above actions" as in Table 2-1, and as in 3-4 on page 3-10?
page 3-3 : Disposal discussion belongs in Executive Summary, first two bullets in 3.1.2 are wrong. All contaminant cannot be removed and probably some verification monitoring would be necessary. Off site disposal must be assumed.
page 3-4 : Last two disadvantages are not valid, 3.2 title should be "Radiation Shielding", concrete problems again, 20 uR/hr over background is an internal standard in 40 CFR 192, not an open land standard. Background plus 25 uR/hr is the UMTRA criterion for outdoor gamma (averaged over 100 square meters).
page 3-5? : Figure 3-1 should be "Radiation Intensity", not "Exposure Rate". No exposure rate data are shown on the figure.
page 3-6 : 20 uR/hr "above background"?
page 3-7 : Problems with first and third disadvantages, recommended grammar
page 3-8 : Invalid considerations
page 3-9 : Recommended grammar
page 3-10 : Problem with "combination alternatives"
page 3-11?: Problems in Table 3-3, again, can all contamination be removed? Really dust problems?

page 3-12?: Problem in Table 3-4, title should read "Streets", recommended grammar in "reason for rejection" portion of table.
page 3-13 : Recommended grammar
page 4-1 : Last bullet conflicts with statements in Section 4.4 (page 4-14), grammar
page 4-3 : Is "01" different than "1"?
page 4-4 : Barker reference cannot be found, returning the contaminant to an excavation is problematic.
page 4-5 : Small volume? Several thousand tons of contaminated asphalt may be present; have you attempted to compute the actual amounts?
page 4-9 : Section 4.3 states "47 uR/hr" when Table 1-3 shows 57 uR/hr on York and 9th Avenue.
page 4-12 : Question about raising manhole - is the price $60.00 or $600.00?
page 4-14 : Volume contingency is low and should be on the order of 25%. Statements about respiratory equipment conflict with the last bullet on page 4-1.
page 5-4 : Why is 40 CFR 192 in neither Table 5-3 nor Appendix B?
References: First page, second from bottom (EPA, Region VIII) is not technically a reference if it is undated and unpublished.
UMTRA Program VPMIM should be included in the references.
Two additional references recommended are:

J. C. Pacer and G. E. Langner, Jr., in preparation, Protocol for the Estimation of Average Indoor Radon Daughter Concentrations, GJ/TMC-09, Bendix Field Engineering Corporation for U.S. Department of Energy, Nuclear Energy Programs, Division of Remedial Actions Project.

G. E. Langer, Jr., in preparation, Procedure Manual for Estimation of Average Indoor Radon Daughter Concentration Using the Radon Progeny Integrating Sampling Unit (RPISU) Method, GJ/TMC-12, Bendix Field Engineering Corporation for U.S. Department of Energy, Nuclear Energy Programs, Division of Remedial Actions Project.

(Appendix A)

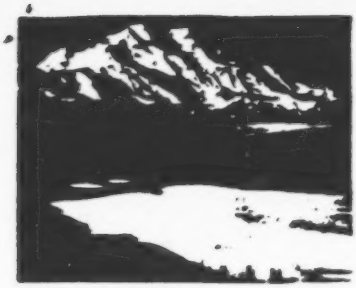
page 1-1 : Gamma radiation exposure standard from 40 CFR 192 is an interior standard.
page 2-3? : Page number for Figure 2-1?
page 2-4? : Page number for Figure 2-2?
page 2-6 : 3-foot statement does not agree with line 1 on page 7-2 of Appendix A.
page 3-1 : Recommended grammar
page 3-3 : Half-life statements are wrong.
page 3-5 : Radon concentrations are not expressed as WL, only RDC.
page 5-2? : "No Scale" statement should be in legend, page number?
page 5-3 : Problem with "sufficiently small" statement; and, CDH considers disturbed utilities to be favorable conduits for radon migration.
page 5-4? : Data do not agree with Table 1-4. Page number?
page 6-3 : Table 6-1 should use mrem to be consistent with text.
page 7-1 : Typos on "escavations" and "effect"

page 7-2 : Sewer lines 2 ft deep? Page 2-6 says 3 ft.
References: Bendix, 1984 does not appear in text.

STREETS:DENVER RADIUM

59

#15



Sunrise, Mt. McKinley — Ansel Adams

SIERRA CLUB
LEGAL DEFENSE FUND, INC.

Symes Building 820 16th St., Suite 514 Denver, Colorado 80202 (303) 892-63

September 10, 1985

SAN FRANCISCO OFFICE
Fredric P. Sutherland
Executive Director
Laurens H. Silver
Michael R. Sherwood
Julie E. McDonald
Stephan C. Volker
Deborah S. Reames
Staff Attorneys
Vawter Parker
Coordinating Attorney
Earl M. Blasser
Of Counsel
Chen Yin Chow
Legal Assistant
Jeanne C. May Klinjums
Director of Development
2044 Fillmore St.
San Francisco, CA 94115
(415) 567-6100
ROCKY MOUNTAIN OFFICE
H. Anthony Ruckel
Karin P. Sheldon
Lori Potter
Staff Attorneys
Douglas L. Honnold
Law Assistant
Symes Building
820 16th St.
Suite 514
Denver, CO 80202
(303) 892-6301
WASHINGTON, D.C. OFFICE
Frederick S. Middleton, III
Howard L. Fox
Durwood J. Zaelke, Jr.
Staff Attorneys
Ronald J. Wilson
Of Counsel
Eric P. Jorgensen
Law Assistant
1424 K St., NW
Suite 600
Washington, D.C. 20005
(202) 347-7770
ALASKA OFFICE
Lauri J. Adams
Staff Attorney
Suzanne La Pierre
Philip S. Barnett
Law Assistant
419 6th St.
Suite 321
Juneau, AK 99801
(907) 586-2751

Marilyn Null
U.S. Environmental Protection Agency
Office of External Affairs
999 18th Street, Suite 1300
Denver, Colorado 80202

Re: Comments on Denver radium sites

Dear Ms. Null:

Pursuant to my conversation with John Brink on August 20, 1985, I submit these comments for your consideration after the official comment deadline but prior to public announcement of a decision on this matter.

Choice of the no-action alternative is inconsistent with the selection of these sites as "contaminated sites that EPA considers most important for thorough investigation and possible cleanup." Super Fund Program Fact Sheet, Denver Radium Site, July 19, 1985. By placing these sites on National Priority List, EPA assumes a responsibility to eliminate or mitigate the hazardous substance which caused the listing.

Even if EPA can prove that a no-action alternative may be proposed consistently with the provisions and purposes of CERCLA, EPA should adopt the alternative which calls for radiation shielding by dense mix concrete or asphalt. The costs of this mitigation action is extremely low in comparison with other Super Fund cleanup actions. Repaving of streets is regularly undertaken as a matter of normal maintenance and repair. For example, the portion of 12th Avenue one block from and immediately parallel to the designated site on 11th Avenue was repaved during the summer of 1985. Therefore, EPA should choose the shielding alternative.

In sum, the Denver radium streets were placed on the National Priority List because they were "contaminated sites ... with the highest priority for cleanup actions." Draft Feasibility Study, July 26, 1985, at page 1-3. Therefore, EPA should choose the radiation shielding alternative proposed in the Draft Study.

Yours truly,

Lori Potter
Rocky Mountain Office

LP/rs

Reproduced from best available copy.

1-27-86

60

ADDENDUM
RESPONSIVENESS SUMMARY
DENVER RADIUM STREETS

On Wed., Jan. 22, John Brink, Phil Nyberg, and Marilyn Null met with a group of citizens living on and near the 100 block of Lafayette Street. The meeting was requested by Sally Russo, resident of 121 Lafayette, and was held in her home.

The group submitted a petition to EPA during the public comment period (Aug. 1-22, 1985) concerning the method by which EPA notified residents along streets contaminated with radium. In early September, the Denver Radium team met with Richard Russo (Sally's husband) to discuss the Denver Radium site and options for dealing with contamination in the streets. In early January, Sally called requesting a meeting.

Citizens at this meeting were interested in the health effects of radiation contamination in the streets, particularly Lafayette Street. They wanted to know what effect the gamma radiation from the streets might have on their children. They were interested in knowing what EPA's recommended final decision would be and how the institutional controls proposed in that decision would work.

John Brink and Phil Nyberg explained the effects of this kind of radiation on human health, and went into detail about the effects on children. John explained the recommended final decision of a modified no action alternative, pointing out that currently there is no acceptable disposal site for Denver Radium materials, even if they were dug up.

The majority of the group thought the concept of the Modified No Action alternative was acceptable, but were concerned about the ability of the City and County of Denver to actually establish and maintain such controls. They identified numerous occasions of digging in the streets which they were sure had not been permitted, thus nullifying any controls that are or may be established. The general consensus of the group, after some discussion, was that the citizens have to be watchful of digging in the streets and contact the proper City & County of Denver departments to ensure that the controls are enforced.

The group further agreed to work with EPA in keeping residents informed by including an article in a newsletter published monthly by the Cherry Creek Improvement Association (CCIA).

In addition, a copy of the Streets FS and a copy of the Denver Radium Community Relations Plan were left with the Russos for interested citizens to review. John told the group that EPA will be accepting comments from citizens until the ROD is signed. He told them that the final deicision would be signed soon, so any comments should be sent to EPA as soon as possible.